SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY AND MANUFACTURES.

Vol. XLIII.—No. 22. [NEW SERIES.] NEW YORK, NOVEMBER 27, 1880. [$3.20 per Annum. [POSTAGE PREPAID.]

A HUGE VACUUM PAN.

We give an engraving of a monster vacuum pan recently made by Messrs. R. Deeley & Co., of New York city, for Mr. C. Spreckles, proprietor of the California Sugar Refinery, San Francisco, Cal.

The pan, beside being unusually large, possesses several points of novelty. The shell, which is 12 feet in diameter, is made of cast iron, and consists of three horizontal sections—the top, the belt, and the bottom. The top and belt are each made in six sections, for convenience in transportation. The several pieces are flanged and carefully fitted, so that when they are bolted together the joints are solid and tight. The pan will hold about 7,600 gallons, which will yield at every strike about 250 to 260 barrels of dry sugar.

The heating surface of the inclosed copper coils is about 1,000 square ft. The lengths of the five coils, beginning with the top coil, are respectively 189, 194, 203 206, and 208 feet. Each coil is divided into four sections, and each section is provided with an inlet and outlet, so that the longest stretch of pipe is about 50 feet. This arrangement insures an effective heating surface and avoids anything like dead and inefficient pipe.

The inlets are connected by brass valves to 10 inch trunks, one trunk being placed on each side of the pan. The outlets, twenty in number, are connected with steam traps, which take off the water of condensation.

The curved overflow pipe at the top is 5 feet in diameter, and the condenser which joins it and reaches through the floor is of the same diameter and 18 feet high. It is provided internally with eights cattering plates for distributing the water used in condensing the steam discharged by the vacuum pan.

There are two thermometers for indicating the temperature of the liquid in the pan, one being placed near the top at the side of the clock to show the temperature of the upper portion of the liquid, the other being placed near the bottom to show the temperature of the lower stratum of liquid.

The pan is provided with two proof sticks for removing a small quantity of the sirup from the pan from time to time for the purpose of testing it. These proof sticks are not what the name might indicate, for they are in reality tubes with nicely fitted valves and a piston for removing the sirup without destroying the vacuum.

Six 5 inch eyeglasses are arranged in different positions for viewing the inside of the pan. The pan is provided with two 4 inch charging valves, which communicate with the interior through two copper pipes reaching nearly to the bottom.

The steam trunks, which supply the heating coils, are each 10 inches in diameter, and each is provided with a steam gauge and with a supply valve, which is connected with a receiver that takes exhaust steam from the engines and steam pumps used in the refinery.

The pan has a 4 inch valve for admitting air in breaking the vacuum. This is one of the largest vacuum pans ever made.

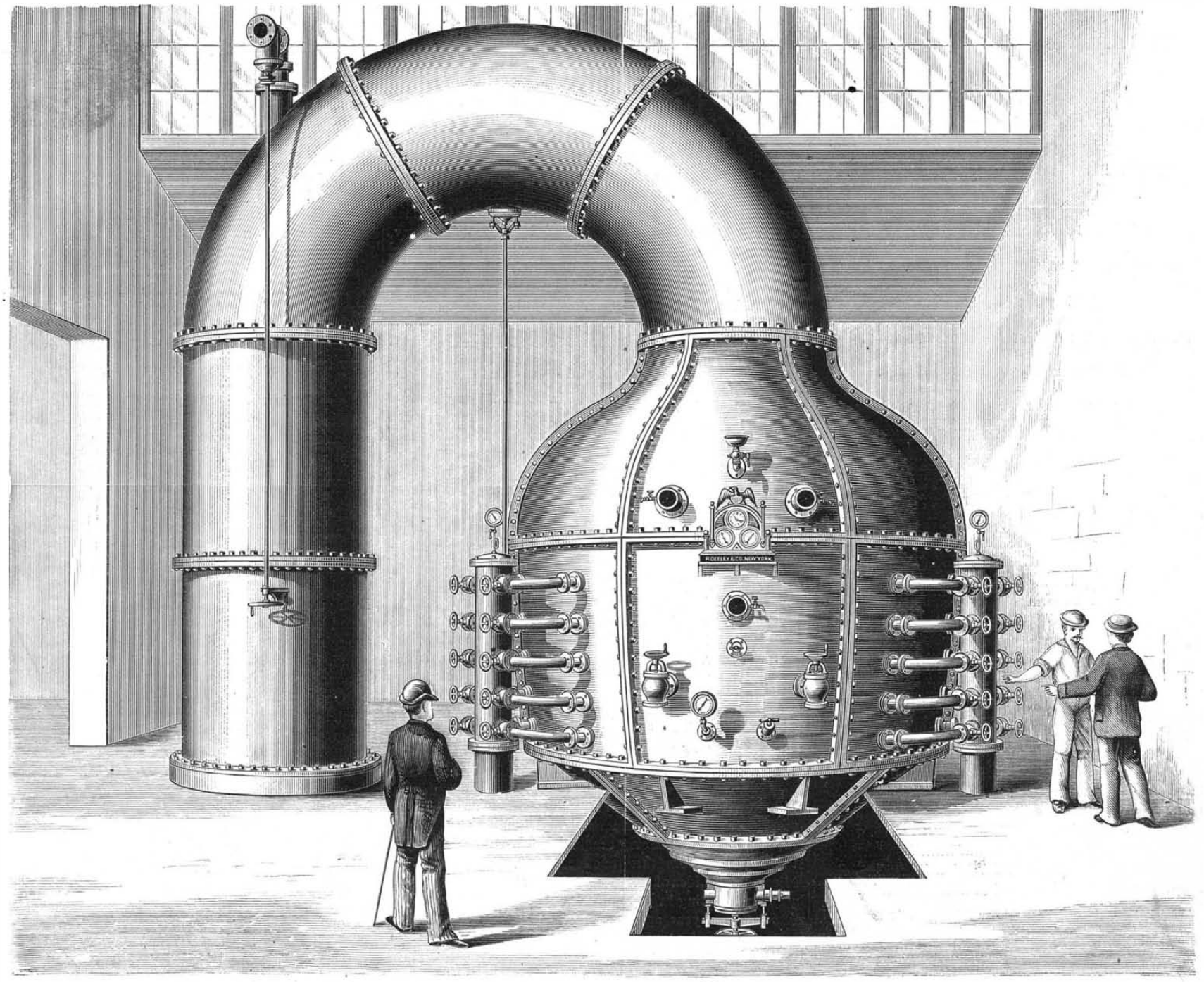
Ozone Experiment.

R. Böttger recommends to moisten a piece of paper uniformly with starch containing cadmium iodide, to let fall upon it a few drops of alcohol or ether, and to set the latter liquid on fire. After its evaporation the paper is found turned decidedly blue in consequence of the formation of ozone.—*Pol. Notizblatt.*

Curiosities of the Voice.

Dr. Delaunay, in a paper read recently before the French Academy of Medicine, gives some details on the history and limits of the human voice, which he obtained after much patient research. According to the doctor, the primitive inhabitants of Europe were all tenors; their descendants of the present day are baritones, and their grandsons will have semibass voices. Looking at different races, he calls attention to the fact that inferior races, such as the negroes, etc., have higher voices than white men. The voice has also a tendency to deepen with age—the tenor of 16 becoming the baritone at 25, and bass at 35. Fair complexioned people have higher voices than the dark skinned, the former being usually sopranos or tenors, the latter contraltos or basses.

Tenors, says the doctor, are slenderly built and thin; basses are stoutly made and corpulent. This may be so, as a rule, but one is inclined to think there are more exceptions to it than are necessary to prove the rule. The same remark applies to the assertion that thoughtful, intelligent men have always a deep toned voice; whereas triflers and frivolous persons have soft, weak voices. The tones of the voice are perceptibly higher, he points out, before than after a meal, which is the reason why tenors dine early, in order that the voice may not suffer. It was almost superfluous for him to remind his learned audience that singers who were prudent eschewed strong drinks and spirituous liquors, especially tenors, for the basses can eat and drink generally with impunity. The south, says the doctor, furnishes the tenors, the north the basses; in proof of which he adds that the majority of French tenors in vogue come from the south of France, while the basses belong to the northern department.



DEELEY'S ENORMOUS VACUUM PAN.

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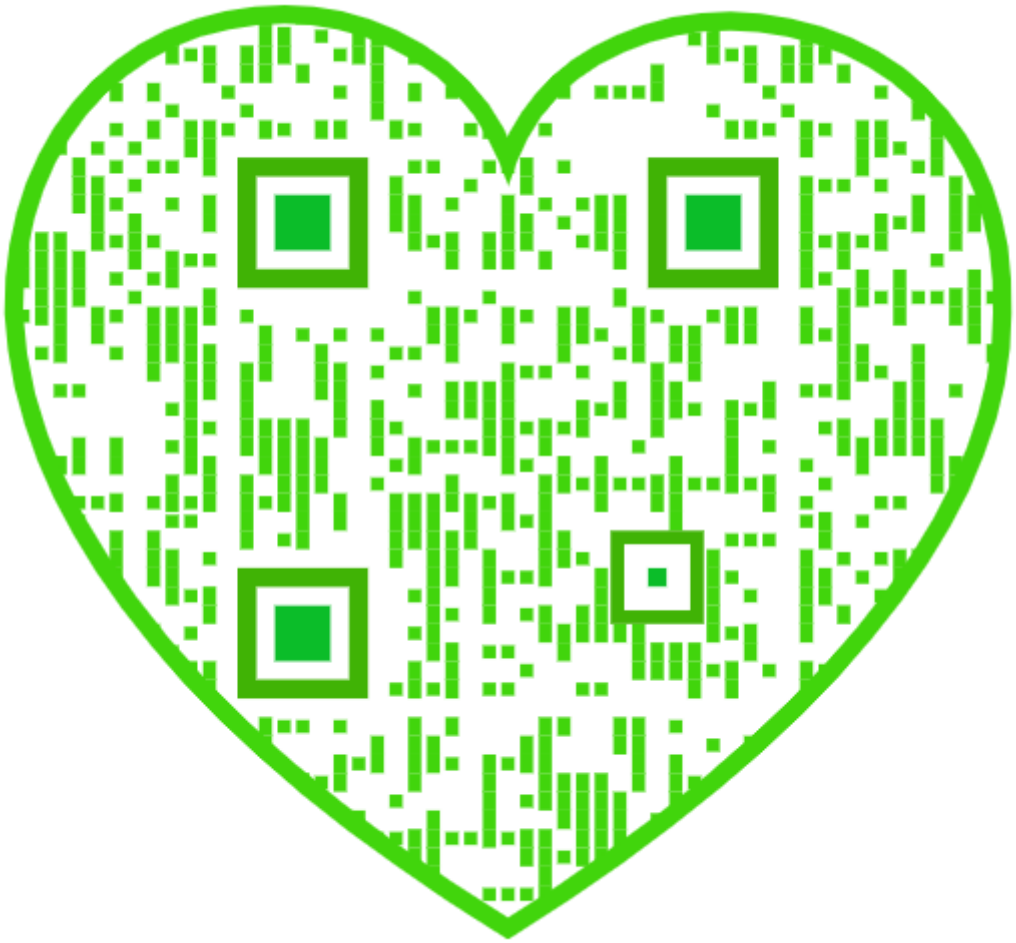

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

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One copy, six months, postage included..... 1 60

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ELECTRIC LIGHTING BY INCANDESCENCE.

For some months it has been pretty generally recognized in this country that, so far as laboratory tests on a considerable scale can determine the general applicability and economy of a novel invention, there could be no serious doubt of the ultimate success of electric lighting by incandescence. At Menlo Park a number of Edison lamps have been kept alight for months together, furnishing as near an approach to perfection in the quality of the light for interior uses as one could ask for, and proving the durability and economy of the lamps. Applied to the steamship Columbia the lamps have made the voyage from New York to Oregon around Cape Horn, thoroughly demonstrating their efficiency and endurance under very trying conditions. With much labor and ingenuity Mr. Edison has reduced the manufacture of his lamps to what may fairly be called a commercial basis, judging by the scale of the manufacture, the simplicity of the processes involved, and the uniformity and cheapness of the resulting product. He has erected a large factory for lamp making, and trained a numerous corps of glass blowers and other workmen for the work in hand. He has built a machine shop, and constructed in it many costly and powerful dynamo machines and other apparatus needed in establishing the working plant of central stations for operating, in this city and elsewhere, practical systems of electric lighting. He has surveyed certain sections of this city preparatory to the general introduction of his lamps, and has made extensive preparations for exhibiting the light at Menlo Park on a scale so large as to demonstrate beyond cavil the practical value of his system for general and economical illumination.

Meantime other incandescent electric lamps, such as Maxim's and Sawyer's, have been on trial in New York and Philadelphia, developing results well calculated to confirm the belief that interior lighting by electric incandescence has got a long way beyond the experimental stage of development, and will pass to that of practical application on a commercial scale as rapidly as the inertia of vested interests and popular customs can be overcome. There are, for example, about one hundred Maxim incandescent lamps in operation in the Equitable Insurance Building in this city.

While all this certain and substantial progress has been making in this country, both to demonstrate the utility and economy of this method of lighting houses and to insure its ultimate if not speedy adoption, the electricians and practical men of England have lost no opportunity to assert the utter futility of any efforts in this direction. The ignorance and incapacity of Americans who, like Mr. Edison, have presumed to argue the feasibility of electric lighting by incandescence, have been ridiculed unsparingly, with much parade of mathematical formulæ and alleged experimental demonstration; and not a little mock sympathy has been wasted on the deluded followers of the incandescent "Will-o'-the-wisp" which was leading so many Americans astray.

It is not a little amusing, therefore, to witness the sudden conversion of these decriers of electric incandescence to a fervent belief in the applicability and economy of such a system of lighting, simply by a single exhibition by an Englishman of what appears from the description furnished to be a close imitation of Mr. Edison's lamp, that is to say, the lamp which Mr. Edison, with characteristic effrontery, has been patenting as his own. As usual, it turns out that Mr. Edison has merely copied, with phenomenal exactness, an invention which an Englishman made years and years ago, but strangely neglected to make public until some time after Mr. Edison's alleged invention had attracted world-wide attention.

At a meeting of the Literary and Philosophical Society, Newcastle-on-Tyne, October 20, Mr. J. W. Swan delivered a lecture on electric lighting, and exhibited a lamp in which light was produced by the incandescence of a slender ring of carbon in a vacuum. In the *Electrician* of October 30 there appears a three-page abstract of Mr. Swan's lecture, and other scientific English papers of corresponding date devote much space to the discussion of the lecture, the new lamp, and the newly demonstrated efficiency of electric lighting by incandescence. We fail to find, however, either in the abstract of the lecture or in the engraved illustration of the lamp, any strikingly original discovery or radical novelty—barring, of course, whatever has been pirated in advance by Mr. Edison and other American inventors and made known in reports of their alleged experiments and inventions. Mr. Swan's plan of distributing the current to his lamps may deserve notice at another time. While pumping the air out of the globe of the lamp, and when the vacuum approaches completion, Mr. Swan heats the filament of carbon to incandescence to expel the gas occluded by the carbon in its cold state; otherwise, he holds, the outrush of occluded gas, the moment the current of electricity is turned on to the finished lamp, would destroy the vacuum, and presumably injure the lamp or lessen its endurance. This precaution Mr. Swan thinks highly important, and doubtless Mr. Edison will agree with him, seeing that he has taken it from the first. It was clearly from this practice of Mr. Swan's that Mr. Edison got his idea of treating platinum and other substances by electric heating in vacuo, as described before the Science Association a year ago last summer. This, however, is a matter of small consequence. The remarkable feature of the case is the sudden change of attitude on the part of many English authorities with respect to the possibility of the successful application of incandescence to the problem of interior lighting by electricity. American workers in this field can scarcely fail to be encouraged by so hopeful a sign.

PROGRESS OF PATENT LAW.

New volumes of Supreme Court reports and of Judge Clifford's decisions have just appeared, having many interesting decisions on patent law. Judge Clifford's learning and ability in this branch are well known. His broad and liberal views have done very much to establish and protect intellectual property; and the intelligence of his serious ill health and probable withdrawal from active duty on the bench will be heard with grave regret.

What inventions are patentable is discussed in several cases. In one the invention was called "comminuted glue." The specification said that the glue of commerce requires a long time for soaking and dissolving it. The patent was for breaking the glue into small particles of uniform size, "grains" in short; after which it might be put up for sale more conveniently and used much more easily. Judge Clifford said that this is really nothing more than grinding glue fine; which is not "new." Articles of manufacture may be new in the commercial sense, which are not new in the sense of the patent law. To render a composition of matter patentable it must be new in the sense of having different properties from anything else in common use. Ground gypsum is comparatively a new article of commerce, but it was never patentable as a new manufacture, for grain has been ground for centuries. Refined sugar was formerly sold in loaves; nowadays it is pulverized and sold as "granulated sugar." In this form it is comparatively a new article of commerce, but it was never patentable as a new manufacture, for every one knew that sugar might be pulverized in various ways. A really new machine for grinding—a new kind of mill—might be patented; but the idea of grinding an article which has previously been sold whole cannot be called a new invention. In another case the inventor said that the former mode of casting steel tires upon iron car wheels involved using a flux to promote the welding of the iron and the steel; to which there were several objections. He proposed by letting the melted iron run in at several holes instead of one, to dispense with the necessity of a flux. The judge said that welding without a flux was not new; blacksmiths have practiced it for a long time. Neither is using several holes instead of one a new idea. Therefore in both cases the decision was against the invention.

The invention must be useful as well as new; but slight utility is enough. Some one devised a child's table waiter, being a waiter having one of its edges turned down instead of up. This edge, by pressing against the edge of the table, prevents the child sitting in front of the waiter from pushing it about by his movements. The court said that this was of some use and that some was enough.

One case required explaining why so much exactness is required by the courts in drawing up specifications. Inventors are gradually learning that long and varied experience is needful to qualify a person for framing specifications aright, and that litigations or losses result from a want of fullness and accuracy in the description. The reasons why the law exacts so much in this respect are not well understood. Judge Clifford says that there are three: 1. That the government may know what they have granted, and what will become public property when the term of the monopoly expires; 2. That licensed persons desiring, during the term, to practice the invention, may know how to make, construct, and use it; 3. That other and subsequent inventors may know what part of the field of invention remains unoccupied.

Every one knows that where an accident or an honest mistake has rendered the inventor's description of his invention incorrect he has an opportunity to surrender his patent and to have it reissued correctly. In a recent case the commissioner of patents considered that an applicant for a patent was claiming more as his invention than was rightfully his, and refused to grant a patent unless the applicant would disclaim the portion deemed to be in excess of his real rights as inventor, and accept a patent for so much only as the commissioner considered he had really invented. He consented to this; and a patent for the reduced claim was issued. Some time afterward he returned, submitted his patent for reissue, and succeeded in getting one—through a new examiner or commissioner probably—which included the claim formerly rejected. The Supreme Court pronounces this a dishonest proceeding and one which cannot be sustained. The judges say that the allowance of claims which an applicant has previously abandoned in order to obtain allowance of his patent, is the occasion of immense frauds against the public. A reissue is allowed to relieve against errors by accident or mistake. When an application has been examined and the claims which are admissible are settled with the acquiescence of the applicant, for him, after the investigation has been forgotten and perhaps new officers have been appointed, to return to the Patent Office, and, under pretense of mistake in his former specification, to obtain a reissue including matters which before were intentionally rejected, is grossly improper. No such patent can stand.

Several cases have been decided upon patents for combinations; and they explain that a person may have a patent for combining old things in some new and ingenious way of working together to produce a new result, also, that under

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such a patent the inventor is entitled not only to the particular elements he used, but also to any mere equivalent of either. What is meant by equivalent seems, if one may judge by the number of cases which during late years have arisen, not to be well understood. Judge Clifford says that the meaning of the rule is this: a patent for an invention combining several old ingredients to produce a new result covers every other ingredient which, in the same arrangement of the parts, will perform the same function, provided it was well known at the date of the patent as a proper substitute for any ingredient described in the specification. There have been instances of a clothes-pressing machine, a sewing machine for stitching sweat cloths to hats, a machine for shaping whip stocks, an improved water meter, a new watchman's time detecter, a machine for pasting papers together, an improved burner for gas stoves, a rock drill, and a self-closing faucet, in which this doctrine has been particularly explained and applied.

The importance of keeping one's invention a secret until it has been secured is illustrated by the misfortune of Mr. Perkins, occurring under circumstances which are of very common occurrence. He invented, in 1857 and in 1863, two machines for use in his own business as a maker of cards and pasteboard. These machines were chiefly run by a workman named Moulton. There were about two dozen workmen in all. The factory doors were usually kept locked and each workman had a key. Occasionally visitors were admitted to see the works. There was no advertising or publishing of the invention; but upon the other hand there was no strict pledge of secrecy exacted from the workmen or the visitors. At last Mr. Perkins took out a patent for his machines. But meantime the workman Moulton had given a description of them to some competitors in the business and they had formed a company and commenced the same manufacture. Perkins sued them for infringement; but the Court decided that he had lost his right by using the machines in the view of his workmen and visitors for more than two years without requiring promises of secrecy. If the inventor has so conducted his affairs that the public have had an opportunity of knowing and imitating his inventions, this, says Judge Lowell, is enough to lose him his right. It is not necessary that the invention should have become known to a great many persons; if any one knew it, and might have made it public without breach of trust, the law considers it has become publicly known.

THE LIVADIA.

This great Russian ship, nearly as broad as she is long, was subjected to a very severe test in respect to her seagoing qualities, during her recent passage across the Bay of Biscay from Brest to Ferrol. *Engineering* gives the following particulars:

The vessel took nearly three days to steam across the Bay. She met with a tremendous sea on the bow, the waves of which have been estimated by a very experienced naval captain of the mercantile marine as 25 feet high. Some on board the Livadia really thought she would be swamped, but as a matter of fact little water came over her except spray. Still she labored heavily, the bow at times rising out of the water and then coming down on her flat bottom, striking the sea with a shock that it was almost thought would knock her bottom out. We do not hear anything in confirmation of the *Times* telegram, stating that a hole had been knocked in her by floating wreckage, but it may be that one of the fore compartments got filled with water and that the first impression was that a hole had been knocked in her as described. Perhaps now there has been time to examine the vessel it has been found that the leakage is due to straining arising from the shocks received as the flat bottom forward struck the water. It is satisfactory at any rate that the ship has arrived safely after encountering a really severe storm in the Bay of Biscay. It is not likely that the vessel will leave Ferrol nearly so early as was at first anticipated. In the meantime she is an object of curiosity to the inhabitants.

The Livadia is fitted with two of Sir William Thomson's newest patent compasses. This instrument, which has been well called the compass of the future, is chiefly distinguished from all other compasses by the form of the card and the devices employed for correcting the various errors due to iron ships. The card consists of a central aluminum boss and an outer aluminum ring laced together by fine silk cords. Eight small wire magnets are threaded into the cords parallel to each other; four on each side of the boss. The points and degrees of azimuth are engraved on a rim of paper running round the ring. This arrangement gives a very light mobile card; its weight being only a twentieth of the ordinary compass card, and its promptness to indicate a change of course is therefore very great. The different kinds of error due to the magnetism of the iron ship are corrected by iron bars variously adjusted round the needle. But in addition to these improvements, the level position of the bowl is secured by the use of knife edges instead of journals for supporting the gimbals, a condition of especial importance in taking azimuths. Moreover, the vibrations of the bowl are advantageously damped by a pool of castor oil placed under the bowl. For taking bearings, whether of sun or stars, lighthouses or landmarks, a new azimuth instrument of Sir William's invention is provided with the compass; and by means of an adjustable deflector, of very simple construction and easy manipulation, a ship is able to determine the error of her compass according to the principle enunciated by Sir E. Sabine, whether at sea or in harbor, without the aid of sights taken of the heavenly bodies or marks on the shore. Indeed those ships of the Clyde which are fitted with Thomson's compass and deflector now proceed to sea without requiring to "swing" in the Gareloch to find their error, and thus a day of the voyage is practically saved. The most recent improvement of the compass is, however, the "spring ring" to prevent the jar of a steamer's engines, or the shock of a man-of-war's gun practice affecting the card. This is an important feature from a naval point of view and will be welcome to the Admiralty, who are reported to desire such a safeguard. The compass was formerly suspended from its standards by India-rubber loops, but these were found to decay in hot climates, and a ring made of a single steel wire wound spirally several times backward and forward round an iron core, so as to make a round hoop of steel rope, has been found very much superior.

AN ELECTRIC LIGHT ACCIDENT.

During the trip of the Livadia one of the stokers of the ship was asked to hold an electric lamp which was being swung up to light the stokehole. The man, being ignorant of the danger, grasped the lamp by the brass rod which runs around it, and at the same time incautiously touched one of the bare wires which supply the electric current. By this act he interposed his body in the track of the powerful current which was, in part at least, diverted from arm to arm across his chest. The shock was sufficient to strike him down dead, all efforts to resuscitate him being unavailing. Nor was the effect due to heart disease induced by the blow, as is sometimes the case with comparatively slight shocks, for it was found next day that the tissues of his body had been disrupted to such a degree by the discharge that immediate burial was resorted to. There can, therefore, be no doubt that the electric current feeding an ordinarily powerful electric lamp of the Jablochkoff type, such as is used in the Livadia, or the other types of Siemens, Lontin, Jamin, etc., is quite capable of causing death to any person who is unfortunate enough to come into contact with it so as to "shunt" the current through any of his vital organs. In passing from one hand to another the current is forced to traverse the breast and lungs, not to speak of the heart and spinal cord. For this reason it is absolutely necessary that great care should be exercised in handling electric lamps, as they are at present constructed. Indeed, it should be made a rule that these apparatus should never be intrusted to any unskilled persons whatever. There is no danger at all short of actual touching with two distinct parts of the body in such a manner as to discharge the current between them; but a person ignorant of the action of the lamp may commit this blunder at any moment, for electricity is invisible, and there is no sign to be seen of the deadly and subtle power which may be lurking in the metal work. Something more than care on the part of those using the electric light would seem, however, to be necessary. There is room for reform in the construction of electric lamps. Hitherto the attention of inventors has been chiefly directed to the proper working of their devices and the insurance of a brilliant light; but henceforth some regard will probably be paid to the safety of their apparatus. Bare wires and terminals ought to be abolished, or at any rate guarded from accidental touch, and electric lanterns made as harmless as ordinary oil and gas lamps.

CAPT. EADS' SHIP RAILWAY.

Capt. Eads writes us from St. Louis that he was to start on November 14 for Mexico, with a staff of engineers and counselors, to make a complete survey of the Isthmus of Tehuantepec, with a view to locating the proper position of a ship railway from ocean to ocean on the general plans illustrated and described in the SCIENTIFIC AMERICAN of November 13 last. Among the members of the party are E. L. Corthell, C.E., who was the resident engineer in charge of the building of the great jetties below New Orleans; George Butler Griffin, C.E., formerly Chief Engineer for the Republic of Colombia, who has also heretofore surveyed the Isthmus of Tehuantepec; and the Hon. A. G. Cochran. Other engineers will join the party in Mexico.

Capt. Eads expects to be absent for two months, and will carefully examine the harbors on both sides of the country. The results of this labor will be looked for with much interest. The ship railway is so much more economical than the canal, in the matter of construction, that the railway is likely to be commenced as soon as a thoroughly good route can be located and surveyed.

How to Travel like Lightning.

An imaginative man, who subscribes himself "A Common Sense Engineer," proposes the following plan by which he holds it possible to transport freight and passengers by rail from New York to San Francisco in ten hours. What the freight or passengers would be good for when delivered he does not pretend to say. The plan is this: "A fair rate of speed for a railway train is forty miles an hour. The distance from New York to San Francisco is, roughly, three thousand miles. I would divide this distance into thirty parts, with stations at every 100 miles. First a track, not differing greatly from the ordinary railroad track, should be laid for a hundred miles, and it is only necessary to study rapid transit according to my plan over this section of the road to understand how the whole system would work. Over the first track of 100 miles, and running over cannon balls upon that track, is another, say 90 miles long, on which, in turn, is another, 80 miles long, and so on till on the whole system the freight and passenger train runs, it being of any desired and practicable length. Suppose it is required to go from A to B, a distance of 100 miles, the stable track over which all the others run is, of course, 100 miles long, and the first movable track upon it is 90 miles long. Let the first movable track be drawn by a stationary engine the 10 remaining 10 miles, whereby one of its extremities will reach B, and let us say that it takes fifteen minutes for it to move through the ten miles. In the meantime the track eighty miles long which runs on the track ninety miles long will have been advanced ten miles by the motion of the ninety mile track, and will itself (either by means of a stationary engine or a locomotive) have advanced ten miles on its own hook, so that in all it will have gone twenty miles in the fifteen minutes, and its extremity will reach B at the same time that B is reached by the ninety mile track. So with the seventy, the sixty, the fifty tracks, and up to the passenger and freight trains, which will reach B as soon as the ninety mile track reaches B—that is to say, in fifteen minutes, at the end of which it will have traveled about 100 miles. Perhaps the following statement will make the matter clearer. Let us call the ninety mile track A, the eighty mile track B, and so on. A is drawn ten miles, carrying with it B for the same distance. But B has a motion of its own and travels over ten miles on its own account. It has therefore gone 20 miles. C, with a ten mile motion of its own over B, which draws it along, has gone 30 miles; D, 40; E, 50; F, 60; G, 70; H, 80; I, 90; J (which is the passenger and freight train), 100 miles, and all in fifteen minutes. The whole system of tracks need not be more than four or five feet in height. With sufficient power the scheme is practicable, and with motors at present at our command it would work for short distances."

A California Grain Chute.

A new chute landing for grain, recently put into operation near Point Sal, Santa Barbara County, California, is described as follows in a local journal:

The framework is entirely on solid rock. The floor is 80 feet above the water, is 260 feet long, and projects out over the water 40 feet. On this projection is a frame 24 feet high. A steel wire cable, seven-eighths of an inch in diameter, passes through pulleys in this frame, and having one end firmly fastened to the solid ledge at the rear, the other end is taken in a boat to the vessel to be loaded, passed over a saddle in the rigging, and then taken beyond and fastened to a buoy which is attached to an anchor weighing 2,500 lb. Three other anchors and buoys are laid, to which the vessel is fastened so as to keep it in position while loading. Half a ton of grain is placed upon a light frame, and attached to a traveler suspended under the wire cable, and away it goes down 300 feet away, where it is dumped upon the deck or into the hold by an upsetting hook, and the traveler is then drawn back by a horse hitched to a rope which passes around a double drum to which is attached a powerful brake to hold the load and regulate the speed when it is going down. One hundred tons of grain can be loaded in ten hours by this arrangement, and double the amount if a dummy engine is used to pull back the traveler. This will be added another year.

A Remarkable Railway Accident.

An almost incredible explanation is given of the cause of a recent accident to the Scotch express, near Leicester, England. It is said that the train was stopped a little beyond the town of Kibworth, the engineer thinking something was the matter with his engine. Examination showed the locomotive to be all right, and the engineer again applied steam, but instead of running forward the train was backed, and the engineer did not notice the change of direction until the train had returned to Kibworth station, where it ran into a freight train, but not before the engineer had applied the Westinghouse brake, and so prevented any more damage than the smashing of two cars and the wounding of four or five passengers. The engineer was suspended; but it appeared from investigation that none of the train hands knew that they were going backward instead of forward until it was too late to avert an accident. It is said by way of explanation that the night of the accident was very dark.

A Suggestion in Photography.

In view of the evil of repeating at elections, fraudulent registration, and so on, a San Francisco gentleman suggests the use of photography as a matter of precaution and certainty. The expense, he says, would not be greater than the present system of registration. The personal history of voters could be put on the back of their respective photographs—so much of it as relates to the birth, naturalization, etc. Voters could all be arranged in wards and precincts as now, and as a number is called and a ballot deposited, the voter's photograph could be dropped into a separate box prepared for that purpose.

Slow Progress of the Telephone in England.

The slow progress which telephonic communication is making in England may be judged from the fact that the successful connection by telephone of the important and closely contiguous cities of Liverpool and Manchester, November 9, was deemed a circumstance worthy of a special cable dispatch to this country. Liverpool and Manchester have half a million inhabitants each, and are thirty-one miles apart!

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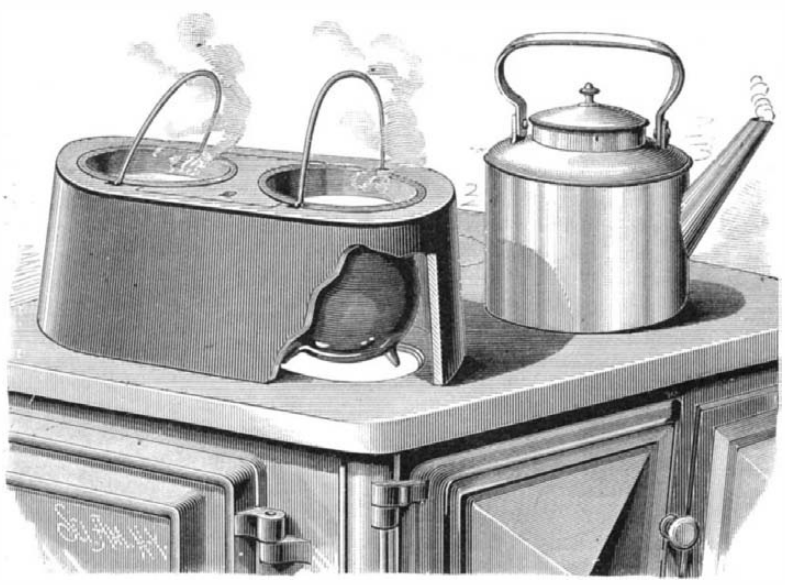
NEW STOVE ATTACHMENT.

The engraving shows an improved attachment for cooking stoves recently patented by Mr. James L. Wilson, of Calhoun, Ga. The object of the invention is to increase the heating power of the fuel by supporting boilers or kettles so as to expose more of their surface to the action of the fire.

The engraving shows the attachment applied to an ordinary wood or coal stove having the usual oblong orifice for receiving a clothes boiler or other heating vessel. The invention consists of a hollow oblong metallic box resting on the stove over the boiler holes and having its lower end open. In the top of this box is an opening closed by ordinary stove hole plates and fitted to the usual furniture of the stove. The engraving shows two pots or kettles suspended by the ears; of course any other heating or cooking vessel can be suspended in the same way. It will be seen that nearly the entire body of the vessel is received by the box and subjected to heat, so that the heating is quickly effected, saving both fuel and time.

Further information may be obtained by addressing the inventor as above.



WILSON'S STOVE ATTACHMENT.

Malonic Acid.

This acid was discovered in 1858 by Dessaigues, who obtained it by the action of bichromate of potassium on malic acid. In 1864 it was obtained synthetically by Hugo Mueller and by Kolbe. Ed. Bourgoin has recently improved upon all the previous methods, and thus describes his method in *Bulletin dela Société Chimique de Paris:* 100 grammes of chloracetic acid was dissolved in twice its weight of water, and the solution saturated with about 110 grammes bicarbonate of potassium. To this was added 75 grammes of pure pulverized cyanide of potassium. When this had dissolved he heated it carefully on a water bath; a brisk ebullition took place, accompanied by the evolution of heat. The liquid, at the close of the operation, was perfectly colorless. Double the volume of concentrated hydrochloric acid was added, the precipitated chloride of potassium removed, and the liquid saturated with a current of hydrochloric acid gas, an operation attended with a considerable elevation of temperature. More chloride of potassium is formed, and some chloride of ammonia, which was deposited on cooling. They are received on an asbestos filter. The liquid was evaporated on a water bath, the residue extracted with ether, which yielded on evaporation 70 grammes of perfectly pure malonic acid.

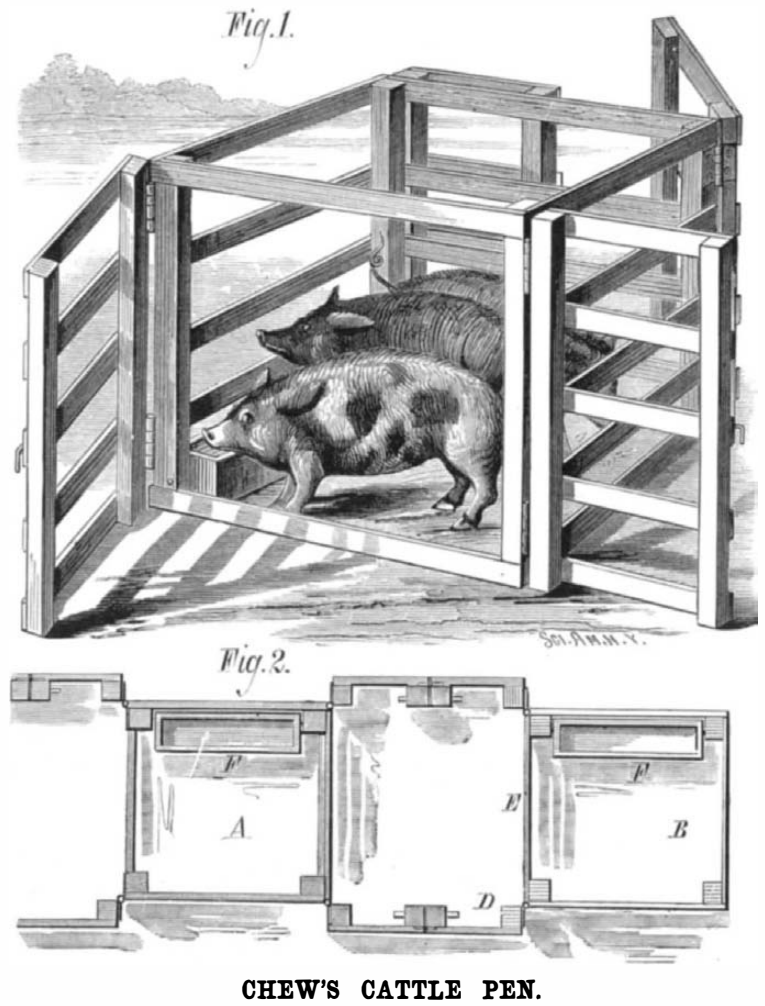
IMPROVED CATTLE PEN.

The engravings show a portable cattle pen made in sections that may be readily transported, and these sections are provided with hinged sides so that they may be easily joined together, forming a series of connected pens.

Fig. 2 is a plan view showing the manner of connecting the sections together. Each section consists of a quadrangular fence composed of vertical posts and horizontal rails or stiles. If desired, vertical palings may be employed instead of horizontal rails or bars. The sections are each provided with a trough, F, which is hinged or pivoted so that it may be turned up out of the way when not in use. Each section is provided with gates, D, on one or more sides, divided in the middle and arranged to swing outward. In the pen shown in the engraving the section, A, has two pairs of gates on two opposite sides, and the sections connected with it have gates on only one side.

The sections may each be used separately as a small pen, or they may be connected together to form a large inclosure. In the latter case the section, A, is arranged in the middle, with its gates on opposite sides opened outward, and the sections, B and C, are placed at the ends, with their gates, G, opened outward, so as to meet the gates of the middle section. The gates are connected to each other by means of the hooks and staples, which are also used for fastening them when closed.

This invention was recently patented by Mr. John C. Chew, of Logan, Iowa, who should be addressed for further information.



CHEW'S CATTLE PEN.

The Milling Industry in America.

Mr. Josef J. van den Wyngaert, who was commissioned by the Prussian Government to make a report concerning the Millers' Exhibition in Cincinnati, is said to have expressed the following opinions on the American industry of milling: In the different mills he had visited in the Eastern part of the United States he had found many excellently constructed, but also many primitive ones, built 30 or 40 years ago.

America had undoubtedly been the most advanced country on earth in regard to milling, and when anything was said at that time about American mills in Europe, as a matter of course only the best and most excellent ones were meant. Since then things have changed. While America, as well as England and France, had come to a standstill, Germany and Austria had excelled remarkably in the progress of this branch of business. The construction of mills in these two countries is to-day much better than that of American mills, and it was only in the last few years that America had made efforts and adopted the improvements of the Germans and Austrians, and taking them for a basis had made further progress. Thus the roller system, for instance, for the grinding of grain, had been transplanted from Germany to America. We had first met with it in Naples, and introduced it into Germany in 1874, from whence it had only in the very last years found its way into America.—*Oesterreichische Ungarische Mueller.*

Method of Determining the Fatty Acids Contained in Oils.

M. Carpentin takes a small flat-bottomed flask or a medicine phial holding about 250 c.c. Into this phial are measured 50 c.c. of the sample of oil, and 100 c.c. of alcohol at 90 per cent, and 3 or 4 drops of tincture of turmeric are added. The phial is then corked and violently shaken. The phial is then placed under a Mohr's burette containing a solution of 40 grms. pure sodium hydrate per liter of water.

As 40 grms. soda saturate 282 of oleic acid, 1 c.c. of the liquid, containing 0·04 grm. soda, corresponds to 0·282 grm. of oleic acid. If another fatty acid has to be determined this number is modified accordingly. The alkaline liquid is carefully dropped into the phial, which is shaken. When a red coloration appears it is corked, agitated for a considerable time till the yellow color reappears, the alcohol having extracted a fresh quantity of acid out of the oil. These operations are continued until the red color becomes permanent. The number of c.c. and the fraction of a c.c. consumed are then multiplied by 0·282 grm., in order to find the quantity of oleic acid present in the sample examined.

Painting a White Hearse Body.

Very little has been said in our columns of late on painting a white hearse, it being the only class of carriages painted in that delicate color. One reason why more hearses are not painted this color is for want of knowledge of its use, and how to apply it. We have seen several jobs finished this way, but they were very poorly executed.

To paint white, oil should be discarded after priming, and in the priming it is not advisable to use all oil in lead. Half oil and half turpentine, with a small quantity of driers, is preferable. Litharge is safest for under coats. After the body is primed, allow it to stand the usual time, and second coat with same color. When sufficiently dry, putty with white lead, putty made with rubbing varnish. Glaze or sheet all over smooth as possible, and if necessary, putty all screw holes and other bad places the second time, so as to have no places to reputty after job is in filling.

To make filling for white work, mix same as ordinary, using all dry lead. Apply this rather stouter than English or other powdered material. Rub carefully with pumice, which will give you a white ground or foundation. When rubbing, keep pumice stone clean, to avoid scratches; also wash clean, particularly in corners. Filling mixed as described is hard to remove from such places; let it stand until the following day, and sand off with fine paper. The job is now ready for color.

Mix your color from best grade of white and fine hard drying body varnish into a thick paste, and reduce with turpentine to whatever consistency your brush requires. Half elastic brushes are best for this work, as the color would be apt to curl or drag under camel hair blenders. Apply two coats of color, and add more hard drying varnish to whatever color is left, and apply with the same brush. Let this stand until dry, when rub down with fine pumice, and apply second coat with more hard drying added. Each coat of rubbing should have some of the white added. Place four coats on, and on the last coat, instead of using fine finishing varnish, you may use same as under coats and polish on it.

Polishing a body is very difficult and tedious, and a large number of our painters know very little about it. When the last rubbing coat is on, let stand for two weeks if possible, and rub with fine pumice, careful not to rub through. Wash clean and chamois dry. Next, rub with rotten stone and sweet oil, with a piece of clean chamois, leaning very heavy, but careful not to heat the varnish. Should the varnish become warm under the rag, stop until cooled.

When the rubbing is finished, sprinkle flour or pulverized slippery alum over the job, and it will remove any particles of oil or moisture that may remain. Most painters prefer flour; this can be taken off by using camel hair duster. After dusting, take a silk handkerchief and rub lightly, leaving your job white and clean. If properly cared for this body will outwear some of our best oil-coated jobs, with no risk of it turning yellow, and seldom cracks, unless sufficient time was not allowed between coats.—*Carriage Monthly.*

To Distinguish Artificial Honey from Bees' Honey.

We have long been aware that much of the honey sold in this country was innocent of any relationship with bees or their work, but we had hoped that the Swiss were more fortunate, that the famous Alpine honey was what it claimed to be. We learn from the *Swiss Bee Journal* (*Bienenzeitung*) that this is not the case, and that not only is glucose the adulterant, but also common molasses and sirup.

Dr. Planta-Reichenau says that the consumption of honey in Switzerland is so enormous that genuine bees' honey cannot be procured in sufficient quantity to meet the demand, hence an artificial product, called "table honey," is extensively employed. In the manufacture of this artificial honey starch sirup and colonial sirup are chiefly employed. The former is imported from France under the name of "glucose crystallisée," and is used for the finest quality of table honey, while the poorer and cheaper kinds are made by mixing it with cane sirup or molasses. Water, flour, and starch are seldom added because so easily detected; the same is true of glycerine.

A determination of the amount of ash does not suffice to distinguish it from real honey unless it is made entirely from best beet or cane sirup. The specific gravity furnishes no better criterion of its genuineness. Adulteration is more easily detected by mixing it with alcohol. A solution of 20 parts honey in 60 of water, when mixed with alcohol, gives a heavy white precipitate of dextrine, if glucose has been added, while natural honey only becomes milky under the same circumstances. The safest method is to determine the sugar. The grape sugar is determined directly in a weighed quantity of honey; an equal weight of the same honey is boiled with two per cent sulphu

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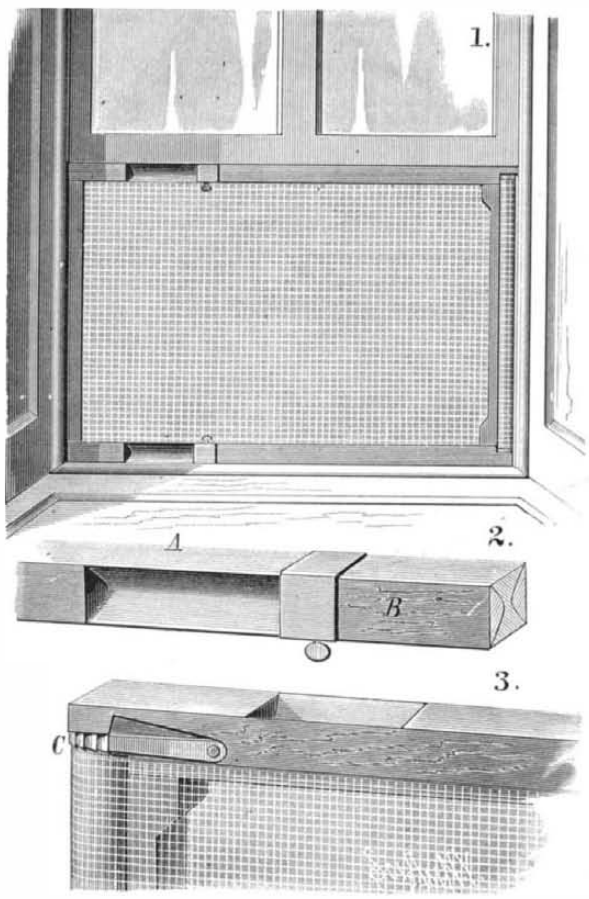
ric acid. and the sugar determined after inversion; finally, the dextrine is determined in a third portion by precipitation with alcohol. The difference in the quantity of sugar found before and after inversion is so great as to furnish a certain method for distinguishing natural and artificial honey. He says that the quantity of dextrine will be proportional to the difference in sugar found before and after inversion, but this is not always true, as some glucose contains no dextrine, and the composition of glucose depends on the method of its manufacture.—*Industrie Blaetter.*

NOVEL WINDOW SCREEN.

The engraving shows an extensible window screen that can be readily adapted to any window, and at the same time



JOSEPH'S WINDOW SCREEN.

is little if any more expensive than screens of the ordinary kind. It is as strong when extended as when closed. The frame of the screen consists of end bars and side bars, the latter being made in two pieces, A B, which are tongued and grooved together, as shown in Fig. 2.

A metal band surrounds the two bars, being attached to the bar, B. A screw passes through this band and enters one of several holes in the bar, A. At one end of the screen frame a roller is journaled in the side bars, B. The netting is attached to the end of the frame opposite the roller and wound on the roller, so that the frame is covered and the surplus wound on the roller.

On the ends of the roller are fixed ratchet wheels, C, which are engaged by spring pawls attached to the bars, B, hold the roller, and the frame prevented from collapsing by the strain of the netting. By this construction a strong and durable extensible screen frame is produced. The side bars are made of uniform size and equally strong throughout. They offer no obstruction to the light and are applicable to all windows.

For further information apply to Mr. John Joseph, 162 Broadway, New York city.

A NOVEL BLIND.

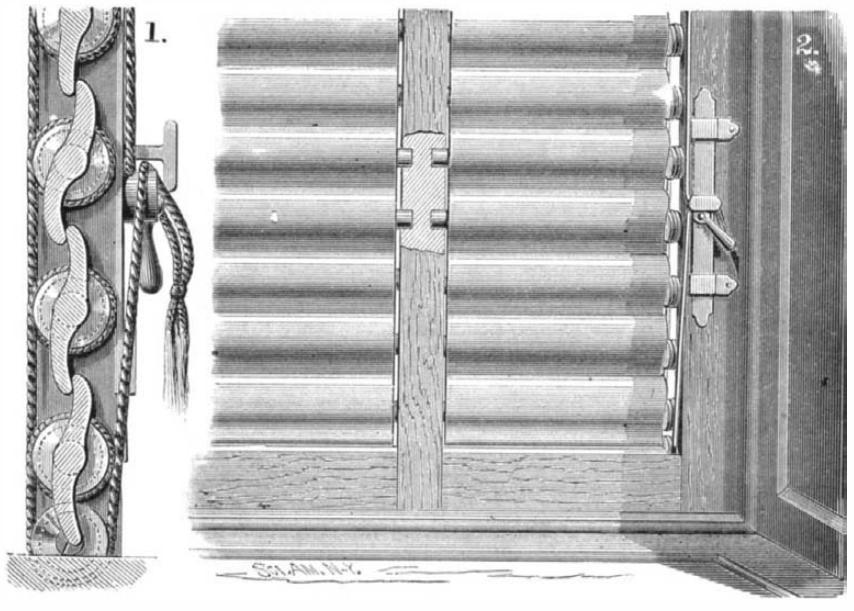
An entirely novel article in the way of window blinds is shown in the annexed engraving. The movable slats consist entirely of glass, either plain pure white or colored any desired tint and cut. The slats have no staples or rods to operate them or interfere with the entrance of light. Each slat has formed on it at one end a small pulley, around which a cord passes which operates all of the slats simultaneously.

For inside shutters these slats are exceedingly well adapted, as they may be of glass, colored to match the carpets and upholstery.

Of course curtains and shades are wholly unnecessary where this blind is used, and it admits of having any desired color of light in the room. It affords good ventilation and prevents the entrance of mosquitoes and flies. It never needs painting, it is always fresh and new, and is ornamental rather than otherwise. Considering its durability and elegance this blind is not expensive. The slats may be cut and engraved, increasing its beauty to any desired extent, and it affords an efficient protection against burglars.

It effectually excludes vision from the outside, while it offers no impediment to the entrance of light, and the light which enters is so softened and diffused as to be incapable of injuring the eyes, or of fading delicate colors in carpets and furniture. The engraving shows the face of a portion of a blind having glass slats in Fig. 1, and Fig. 2 is a vertical transverse section showing the form of the slats and the relative size of the glass pulleys.

This novelty is manufactured by the Corning Glass Blind Company, Corning, N. Y., who should be addressed for further information.



GOFF'S GLASS BLIND.

Liquefaction of Ozone.

At a recent meeting of the French Academy, MM. Hautefeuille and Chappuis announced that they had liquefied ozone. These chemists have been able to ozonize oxygen to a greater extent than has hitherto been done, by passing the silent discharge through the oxygen at a low temperature. The tube containing oxygen was immersed in liquid methylic chloride, which boils at —23°. After being submitted to the electric discharge for fifteen minutes at this temperature, the oxygen was conducted into the capillary tube of a Cailletet's apparatus, the temperature of which was maintained at —23°.

After a few strokes of the pump the gas in the tube appeared azure blue; as pressure increased the depth of color likewise increased, until under a pressure of several atmospheres the ozonized oxygen appeared dark indigo blue. The pressure was increased to ninety-five atmospheres, and was then suddenly removed, whereupon a mist, indicating liquefaction, appeared in the capillary tube.

The stability of a mixture of oxygen and ozone rich in ozone appears to be chiefly dependent on the temperature. If such a mixture be rapidly compressed at ordinary temperatures, a considerable amount of heat is evolved and the gas explodes.

Ozone, say MM. Hautefeuille and Chappuis, is, therefore, to be placed in the category of explosive gases.

Berthelot has shown that the transformation of oxygen into ozone is attended with absorption of heat; the stability of products of endothermic reactions is, as a rule, increased by decreasing temperature.

Ozone is much more easily liquefied than oxygen; the latter must be compressed under 300 atmospheres at about the temperature of —29° before sudden removal of pressure succeeds in producing liquefaction.

We have thus the existence through a large range of temperature and pressure of two allotropic forms of the same element, each with distinctly marked chemical and physical properties. We know that the molecule of oxygen has a simpler structure than that of ozone; the substance of simpler molecular structure is capable of existing through a much more extended range of temperature and pressure than that of more complex structure. Under special physical conditions it seems possible that new allotropic modifications of various elements might be produced.

The marked differences in color, and in temperature of liquefaction, between oxygen and ozone, furnish another illustration of the close connection which exists between the "chemical structure" and physical properties of substances; a different "linking," even of similar atoms, being evidently associated with distinctly different physical properties.

MM. Hautefeuille and Chappuis will doubtless soon be able to furnish more details of the properties of this most interesting substance, liquid ozone.—*M. M. P. M., in Nature.*

Crystals of Chromium Sesquichloride.

M. A. Mengeot allows hydrochloric acid to act upon potassium bichromate dissolved in water. If the solution is allowed to evaporate for about ten months the bottom of the vessel is found lined with deep violet crystals of chromium sesquichloride, but among these large violet crystals are some small green crystals of a salt of chromium. According to all authorities the green salts are only formed at 100°; they are not crystalline, and they gradually pass into the violet condition. But the production of these green crystals takes place at common temperatures, and they have remained green for more than two years.

AN IMPROVED CHURN.

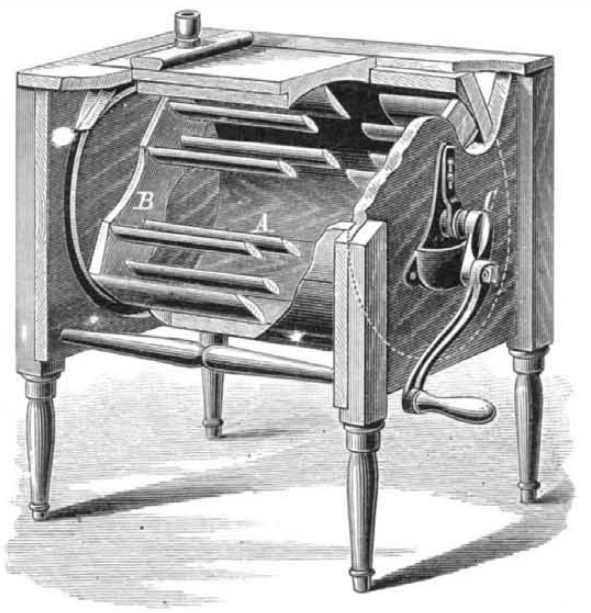
The engraving represents an improved rotary churn having a cylindrical body, whose inner surface is made continuous and unbroken, so that the dasher may revolve in contact with it and clear it of adhering cream. The dasher, A, is of peculiar construction, having blades set in the end pieces, B, so that they alternate in position, and when in motion give an undulatory movement to the cream, which thoroughly agitates it without breaking the globules.

With this construction the entire body of the cream is uniformly acted upon and converted into butter without loss, and the butter produced will be of a uniform quality.

Besides the features already described the dasher has a bearing at each end provided with a cup for catching any cream that may find its way through it around the shaft.

The crank is held in place by a plate, C, which enters a groove in the shaft, and is held in place by set screws.

The cylindrical body of the churn is held together by metal straps drawn together at the bottom of the churn by tangent screws.



MURCH'S CHURN.

This churn is easily taken care of, and is said to be thoroughly efficient. It is the result of a number of years' study on the part of the inventor, and it possesses points of novelty and usefulness that will be understood and appreciated by those familiar with the subject.

Further information may be obtained by addressing the patentee, Mr. Lewis W. Murch, of Kennedy, N. Y.

MISCELLANEOUS INVENTIONS.

An improved grain register has been patented by Mr. William B. Richardson, of Wolf's Mill, Texas. The object of this invention is to furnish registers for recording the quantity of grain measured and sacked. It is simple in construction and accurate in operation.

An improved hame hook has been patented by Mr. Moses C. Hargrave, of Wilmington, N. C. This invention relates to certain improvements in hame hooks designed to permit the worn end of the hook to be renewed and replaced by another without trouble or delay, and it consists in a peculiar hook formed in detachable parts.

An improvement in breech-loading firearms has been patented by Mr. Theodore D. Bartley, of Dresden Center, N. Y. The invention consists in a novel construction and arrangement of the breech-block and the hammer, whereby provision is made for depressing the breech-block by means of a spring and for elevating it by the motion of the hammer.

An improvement in the manufacture of artificial birds has been patented by Mr. Charles H. Bodurtha, of Delaware, Ohio. The object of this invention is to produce birds in relief covered with natural feathers, and thereby obtain a more natural and ornamental appearance than by any method heretofore practiced; and the invention consists in first forming the body from plastic material upon the prepared sheet and covering it with feathers.

Mr. Caleb W. Mitchell, of Saratoga Springs, N. Y., has patented an improved table for dispensing liquors, which is simple and convenient. It consists in combining a peculiarly constructed bottle rack with an ice box.

Messrs. Jacob S. Lowe and John H. Leiter, of Shelby, Ohio, have patented a combination ruler for facilitating mechanical drawing. The invention is especially designed for schools, and is also useful to the mechanical draughtsman and others. It consists of a series of rulers having uniform scales of inches and fractions of inches adjustably suspended on a horizontal rod, which is fixed in a headboard on the top of a blackboard or on a desk, said rulers being arranged in such a manner that by their use geometrically correct drawings of all kinds can be made.

Mr. Sewell S. Hepbron, of Fairlee, Md.,

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has patented an improvement in the class of thill couplings in which the thill iron is secured to the clip bolt by means of a spring plate fastened to the under side of the thill iron by a screw bolt.

Mr. William Langdon, of Upland, Pa., has patented a spirit level whose stock consists of an oblong bottom supporting a slotted vertical tube at each end, a transverse horizontal slotted tube in the middle, and a superposed median horizontal slotted tube over and at right angles to the middle tube. This invention is intended to meet all of the requirements for a plumb and level indicator.

Mr. John C. Isaac, of Cornwall-on-the-Hudson, N. Y., has patented a corner stone for boundary lines, consisting of a cast iron post having on four sides dovetail grooves for receiving blocks inscribed with letters. These blocks are held in their places by an iron cap which is secured by a rod running through the base of the post.

An improved permutation lock has been patented by Mr. Fred. E. Arnold, of Chicago, Ill. This invention consists in certain novel details of construction and arrangement of a sliding bolt, gear wheels, and setting devices, whereby provision is made for securing the bolt to prevent it from being moved without a knowledge of the arrangement of the parts with relation to each other.

An improved cultivator tooth has been patented by Mr. Levi S. Wood, of Marion, Ia. The object of this invention is to furnish cultivator teeth so constructed as to cut shallow near the plants and deeper at a little distance from the plants, which may be guided close to the plants, will not cover small plants with soil, and will leave the soil loose and level.

Messrs. Gavin Rainnie and George J. A. Robinson, of St. John, New Brunswick, Canada, have patented an iron fence post of a body made U-shaped in its cross section, and having hooked lugs to receive the fence wires, the base cast hollow and solid with the body, and having holes in its top and bottom and ribs upon its inner surface to receive and bind the ground rods.

Mr. Samuel Levin, of Pittsburg, Pa., has patented an improvement in eyeglasses which are employed upon one eye at a time—such, for instance, as watchmakers', lithographers', and engravers' glasses—and which improvement is applicable also to goggles, eye-shades, etc. The improvement is designed to relieve the operator from the effort of holding his glass by the contraction of the muscles about the eye, and to avoid the use of bandages or ligature passing entirely around the head.

Mr. Anton V. Semrad, of Chicago, Ill., has patented an improved mangle, consisting of a table supporting two rollers, which are pressed down upon the clothes by a weighted box resting on the rollers.

An asparagus buncher, so constructed as to gauge the bunches, press the stalks together, and hold them while being tied, has been patented by Mr. John Weeks and Frank H. Weeks, of Brooklyn, E. D., N. Y. The invention consists in a bed plate, an upright plate, two stationary jaws, and two movable jaws, and mechanism for operating the movable jaws.

An improved register knob has been patented by Mr. Geo. W. Lewin, of Somerset (Fall River P. O.), Mass. The invention consists of a slide having a boss in combination with a register knob having a perforate shell, spring, and flanged washer, all held together by a screw and nut.

An improvement in fences has been patented by Mr. Lewis W. Berger, of Canal Winchester, Ohio. The object of this invention is to furnish fences so constructed that they can be easily and quickly set up, taken down, and moved from place to place, and which will allow any desired panel to be removed to open a passage way without disturbing the other panels.

Our Trade with Sheffield.

The report of our Consul at Sheffield, Eng., shows that a vast increase has taken place in the exports from Sheffield to the United States during the year ending with September. The exports of steel during the last quarter were valued at £101,428 as compared with £52,550 for the same quarter last year; and the cutlery exports for the same periods were respectively £74,104 and £50,504. For the year the steel exports amounted to £383,889, and the cutlery to £238,605. The total exports from Sheffield to this country for the year amounted to £1,066,411 as compared with £559,733 last year.

Mr. Vanderbilt has recently given a very heavy order for steel rails to one of the Sheffield firms for delivery next year.

The Oldest Scientific Society.

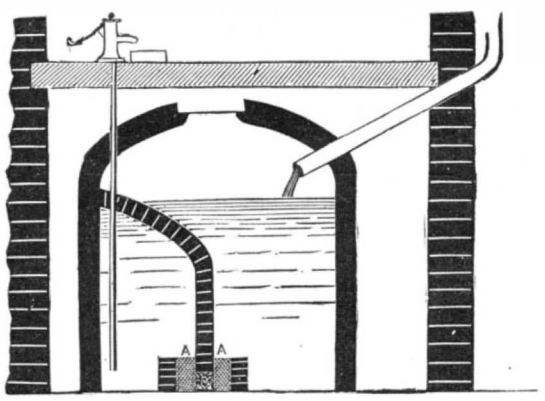
The Academy of the Lyncæi, according to M. De Laveleye, is the oldest scientific society in existence. It was founded at the beginning of the seventeenth century by four young men, who took as their symbol the Lynx—an animal then to be found in the Apennines—with the motto, *Sagacius ista.* The members "were to penetrate into the interior of things in order to know the causes and operations of nature, as it is said the lynx does, which sees not only what is outside, but what is hidden within." Their dream was nothing less than the organization of modern science based on the method of observation—the *church* of knowledge. The Academy was to have in the four quarters of the globe dwellings with sufficient endowments to maintain the members, who might live there in common. These dwellings were to be provided with libraries, laboratories, museums, printing presses, and botanical gardens—in a word, with everything necessary for study. Their observations were to be communicated by writing to all the members. The Lyncæi were to renounce marriage as a *mollis* and *effeminata requies,* and injurious to study; nevertheless, monks were not admitted. The Academy was reorganized in 1875, and has members of various nationalities. Among the English members are Gladstone, Freeman, Rawlinson, and Herbert Spencer.

FILTERING CISTERNS.

The charcoal for filters is probably most efficient if animal, *i. e.,* bone black; but as it is not always easily obtained, that ordinarily sold by the dealers, made from hard wood, pounded up fine, is good enough. If your sand or gravel is not clean, wash it in plenty of water. Sponges are not of much use, being perishable. The best material for rain water cisterns is brick, laid in hydraulic cement and plastered inside. No lime should be used for the plastering, but a mortar made of equal parts of cement and good, clean, sharp sand. This is rarely found clean enough to be used without first washing it. After the plastering is hard, it should be washed twice with a grout of cement and water, without sand, applied with a whitewash brush. If the ground is firm, and stands plumb without caving in, one layer of brick laid directly against the side of the pit is enough. In this case the form of the pit should be carefully trimmed to a true circle, and the walls trimmed plumb. Then the brickwork can be laid directly against it, filling all small cavities between the brick and ground with cement, and not with earth. If the ground is not firm enough to stand in this way, a thicker wall will be needed, say eight inches. The earth that is filled around it should be puddled in with plenty of water, to insure a solid packing. Ramming the earth without puddling is not so good, and will not be likely to prevent the cistern from bursting when first filled with water. A very small crack will spoil it. The floor can be laid after the walls are plastered, so as to avoid stepping on it much after laying it. The floor should be dished like a saucer, to facilitate cleaning out.

For filtering, build a partition in the cistern by which any portion, say one-fourth, of its contents can be separated from the remainder. Insert the suction pipe or pump within this chamber, and allow the inlets to discharge outside of it in the larger part of the cistern. If the partition is built of one thickness of soft, porous brick the water will soak through it; but this brick partition should be domed over against the side walls to prevent any pollution of the filtered water by dust or spatterings from above. If the water is quite foul the pores of the bricks will be choked in time, and refuse to pass more water. In that case the partition must be renewed, or holes made near the bottom in which sponges, broken charcoal, or sand can be placed to do the work; and these can be renewed when found necessary.

If gravel and charcoal are used, they are deposited in layers, charcoal at bottom, and a few inches of gravel on top, each side the filtering wall, at A A (see cut), and confined by



FILTERING CISTERN.

dwarf walls on each side. Holes are left in the base of the filtering walls by omitting alternate bricks in the bottom course. The water is then filtered by passing down through one bed of charcoal and up through the other. The gravel is chiefly useful to put on top of the charcoal to protect it from wash.

This charcoal will need frequent renewal if there is much solid matter in the water. Hence two cisterns are convenient, so that one may be used while renewing the other.

The source of ice is often so questionable in its purity that it is doubtless the safer way to cool one's water for drinking without direct contact with the ice. Any metal that is difficult to corrode, like copper, is good to put the ice in, and if made double on the outside with an air space between the plates, it will not absorb much heat from the outside air. The very best material for holding the drinking water is glass, and if made thin, it will conduct the heat fast enough for all practical purposes, being immersed in the ice for such time as is found necessary. The cooling of the water can be much hastened, but the melting of the ice is also hastened, by putting a little salt in it, which makes a freezing mixture and cools off all the surrounding substances rapidly.

Lead pipe is not a desirable material inside of cisterns for drinking water. Iron is better, using gas pipe, coated inside with hydraulic cement. If this is carefully prepared and carefully handled while putting it together, it is nearly indestructible. It is used with success for service pipe in many New England cities, where it has been in use for many years, usually being adopted between the street mains and houses. —*The Plumber and Sanitary Engineer.*

HYDRAULIC CEMENT.

BY H. C. HOVEY.

It is well known that common mortar hardens by drying, and that under water it gradually softens till it is dissolved away. To facilitate its setting, as well as to cheapen its cost, sand is mixed with lime, in the proportion of three to one, with just enough water to make a paste. When this yielding substance is properly used in masonry it becomes hard and adhesive, filling the joints completely and uniting the bricks or stones into a compact mass that may endure for centuries. Hydraulic mortar, that will "set" under water, is made by the admixture of ingredients that will in some way protect the lime from chemical aqueous action. The oldest recipe for its manufacture is given by Vitruvius, the Roman architect, and many have been given since, until the making of artificial cements has become a subject of very great importance. It is claimed by antiquarians that the art, indeed, dates back to the Neolithic age; and that ancient pottery, instead of being hardened by exposure to heat, was made from a mixture resembling Portland cement, and hardening without being baked. Prof. E. T. Cox has carefully analyzed Indian pottery found in Western mounds, showing the material to be a skillful admixture of calcareous, silicious, and aluminous earths, in proportions varying but little from the modern cements in familiar use.

This communication, however, chiefly relates to what are known as natural cements, whose commercial value has been largely developed in this country during the past ten years, and is capable of much greater development.

It is, no doubt, quite mysterious to those who have not given the subject particular attention, that there should be a class of stones that, having first been calcined and then reduced to powder, can be used as a mortar without being mixed with other mineral ingredients; and that this mortar, instead of crumbling or dissolving under water, is actually hardened by that very means until it is as firm as the rocks it binds together. This fact is said to have been discovered by a Mr. Parker, who took out a patent about sixty years ago for what he called Roman cement, though made from septaria found on the Isle of Sheppey. Medina cement is produced from similar argillo-calcareous nodules found on the Isle of Wight. Satisfactory experiments with septaria were also made in France and Russia. The Portland cement is an artificial imitation of these natural ones, by mixing masses of chalk and clay in certain proportions, drying the substance, and then treating it by a process like that to which the natural nodules had been subjected.

It is now known that many limestones, heretofore rejected as poor, if not worthless, contain naturally the very impurities, so to speak, most desirable to form a mortar capable of hardening under water. The true proportion to form a silicate of lime and alumina is according to the following formula: Silicic acid, 20·00; lime, 41·40; alumina, 38·60.

The combining ratio is 100 of silicic acid to 398 of the earthy bases. But it is a curious fact that water limestones, widely differing from each other in the proportion of their chemical constituents, often seem to have for practical purposes nearly equal hydraulic properties. The explanation is that the combining ratio varies with the relative quantities of effective substances. For instance, if lime and magnesia form the base, instead of lime and alumina, the ratio of silicic acid to this base should be as 100 to 277; and if lime alone, as 100 to 200. The presence of iron, sulphur, soda, or other ingredients, will, of course, cause a further variation of the ratio.

The reader may be interested in an account of one or two of the chief cement works in this country that may be regarded as specimens of all, for there is no great divergence in the process of manufacture. I had an opportunity a few weeks ago to visit the Howe's Cave Lime and Cement Works, in Schoharie Co., N. Y. This interest has been developed since 1870, although something had been done in a small way prior to that date. The credit of the enterprise is largely due to Hon. J. H. Ramsey, of Albany. The kilns and mill are situated about 500 yards from the mouth of Howe's Cave, and at the foot of a bluff from 100 to 200 feet in height. Into the face of this bluff a tunnel has been cut, about 8 feet from floor to roof, and extending in for 800 feet, the rock on either side being honeycombed by lateral branches. The whole bluff is limestone, the upper strata belonging to the Pentamerus and Delthyris groups, abounding in crinoids, shells, and corallines. Excellent lime is made from this material in the usual way. The lower strata of water limestone at the foot of the bluff, and profitable for working up into cement, are three in number, and altogether but 5½ feet thick.

Pipes from an engine in the mill convey the power into the tunnel to drive two steel drills, each one inch and a half in diameter, by compressed air. Two men are required to manage a drill. After a quantity of stone is dislodged by blasting it is carted out over a tramway. From 75 to 100 tons is regarded as a good day's work. A kiln burner takes the loads, that have already been assorted in the mine, and deposits the material in four kilns, two of which are always in use, and both together able to burn 200 barrels a day. The kilns are 30 feet deep, each rigged with what is called a "kettle," through the bottom of which the calcined stone is drawn out and taken by an incline up into the mill. There it first goes into a "cracker," where it is crushed into pieces about the size of walnuts. Next it is pulverized between millstones into a light brown powder. This falls into barrels that stand on what are termed "packers," which jump them up and down by steam power, causing

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the cement to pack together into much less space than it would otherwise occupy. One man heads for two packers. A barrel ready for shipping is worth about 80 cents. The capacity of the mill is 60,000 barrels a year. This cement has a good reputation, and the company have all they can do to fill orders. Besides furnishing cement for various railroads and for government custom houses, they supplied 50,000 barrels for the new Capitol at Albany, and sent also 20 car loads for the State House being built at Indianapolis, there being in each case numerous competitors.

There are many other cement mills in the country, all run, however, very much in the same way. The Buffalo Cement Company make two grades, having no material chemical difference, but differing in process of manufacture. The ordinary cement is bolted, by which means the vitreous grains are separated and ground over again into what they brand as the "Buffalo-Portland Cement," and which, it is claimed, makes a remarkably hard and durable concrete. This process is patented by the inventors.

One of the oldest cement mills in the West belongs to Mr. W. F. Beach, of Clarksville, Indiana, and is situated near the Falls of the Ohio. The bed of hydraulic limestone here is 14 feet thick, and, according to Prof. E. T. Cox, its outcrop has been traced on 25,000 acres of exposed workable beds, and there are probably 20,000 acres more that may be reached by shafts or tunnels. Beach's mill has a capacity of 50,000 barrels per annum. Eleven mills in all are reported as running in 1879 in the State of Indiana. Six of them, together with those on the Kentucky shore, were, and probably are still, united under the name of the Union Cement Association, and the material made by them is known in market as the "Louisville Cement." A year or two ago I saw a statement that their annual capacity was 400,000 barrels, and their actual sales for the preceding year were 391,166 barrels. The supply is practically inexhaustible, and the demand is constantly increasing, as the public is becoming aware of the many uses to which cement is put already in Europe, and which it may also advantageously serve in our own country.

DECISIONS RELATING TO PATENTS.

U. S. Circuit Court—Southern District of New York.

CAMPBELL *vs.* JAMES, *et al.*—CANCELING STAMP.

Wheeler, J.:

1. The reissued letters patent No. 4,143 (Division A), granted to Helen M. Ingalls, October 4, 1870, for an improvement in postmarking and canceling stamp, the original patent having been granted to Marcus P. Norton, April 14, 1863, and reissued to Jacob Shavor and A. C. Corse, August 23, 1864, and reissued to M. P. Norton, August 3, 1869, declared valid.

2. The judgment of the Commissioner of Patents in disbarring a solicitor for surreptitiously placing a copy of a caveat in the official files extends only to the exclusion of the solicitor, and not to the effect of the paper as evidence *in pais*, although its effect upon the instrument as a caveat of record might be greater.

3. Where a document is introduced in evidence by a defendant to prove admissions by the inventor inconsistent with his claim, such document is legitimate evidence according to what should appear its just weight, as well as those facts in favor of the inventor as to such as are against him.

4. Although the weight of evidence might be in the defendants' favor if the question as to prior use of the invention were to be determined upon a fair balance of proof and upon the parol evidence alone, still, in order to defeat the patent by showing an invention prior to a clearly established one of the patentee, it must be as clearly established to the extent at least of removing all fair and reasonable doubts.

5. By the provision of the act of 1836, section 15, it was only public use or sale with the consent and allowance of a patentee before the application for a patent that would defeat the patent. The act of 1839, section 7, did not change the character of the public use or sale that would defeat a patent, but provided that no patent should be held invalid by reason of them unless "such purchase, sale, or prior use has been for more than two years prior to such application for patent."

6. The defense of public use for more than two years prior to the filing of the application upon which the patent was granted must be clearly proven. A private use for testing the invention, and informing the inventor as to its perfection and usefulness, with the design on his part all the while to procure a patent, will not sustain such defense.

7. If the reissues of an original patent are for any other or substantially different invention from that described in such original patent, they are unquestionably void; but the fact that the specifications or claims are different, the invention or discovery remaining the same, is of no consequence.

8. If a form of a device embraced in a reissued patent had not been mentioned in the original patent, it might well be said not to have formed any part of the conception of the inventor; but if described in such original patent, although referred to as not being so useful or desirable in the combination as another form of such device, it might nevertheless be properly embraced by the reissued patent.

9. It is doubtless true that a reissue of a patent to a person not the owner would not affect the title of the owner. The reissue and title should go together to make a good title to the reissue, or at least the reissue should be consented to by the true owner.

10. The defense that the plaintiff's title fails because one of the parties through whom such title is derived did not own the patent when it was surrendered by and reissued to him was sought to be sustained by showing that a certain instrument of writing was forged by such party by placing it before and attaching it to the genuine execution of another and a different instrument. It appearing that the parties whose assignment such instrument purported to be had knowingly acted under the same: *Held*, that this ratified and confirmed the instrument as good from the beginning.

11. A conveyance executed by the signature of a company with seal, and by S., president, and another seal, is a good execution both for the company and for S. individually.

12. It appearing that the conveyance was one expressly in trust, upon condition that the plaintiff should have the sole management of the trust until a fair, just, and reasonable settlement should be had with the United States for the use of the invention in the postal service of the United States by the Post Office Department: *Held*, that as no such settlement had been made the limitation in the conveyance had not expired, and the right to bring suit for infringement was in the plaintiff.

13. The grant of letters patent for an invention is exclusive throughout the United States, and reserves no right to the Government to use the same.

United States Circuit Court.—Southern District of New York.

CAMPBELL *vs.* JAMES *et al.*—PATENT CANCELING STAMP.

Wheeler, J.:

1. The bill charged infringement by defendant while the patent was owned by plaintiff's assignee, and set forth in *hæc verba* the assignment of the patent, together with "all the right, interest, and claim for and to the past use of said invention and improvement under the said letters patent," and prayed for an injunction and for an increase of damages, "in addition to the profits and gains to be accounted for by the defendant," together with "such other and further relief as shall be agreeable in equity." *Held*, that the assignment which was proved by the instrument itself applied to infringement before as well as after assignment, and that the plaintiff was entitled to recover under such bill without doing violence to any of the well-settled rules of pleading.

2. It is now well settled that savings in cost by infringement of a patent may be recovered as profits. (*Carcood Patent*, 94 U. S., 695; *Elizabeth* v. *Pavement Company*, 97 U. S., 126.)

3. An exception to the Master's report that the defendant might have used other forms of canceling stamps which would not have infringed, and that the saving by using plaintiff's invention instead of such other stamps would have been much less than that reported, *overruled*, it not appearing that any such other form was known to defendant or that the use of the same would not also have been an infringement.

4. An exception taken to the Master's report on the ground that plaintiff's device is one which can be used only by the postal service, which is wholly monopolized by the Government, which could send letters without postmarking them, or could lessen the frequency of the mails so that the postmarking could be done separately from the cancellation of the stamps by the old method without increase of clerical force, thus leaving the invention subject as to use and value entirely to the will of the Post Office Department, so that the use of it in the postal service would not deprive the owner of any opportunity to have it used otherwise and could not damnify him, and that, therefore, no damage can be recovered in the case, and that no profits can be recovered because there is no party before the court or that can be brought before the court who has received any, *overruled*, it appearing that the Post Office Department required the mails to be sent with certain frequency, and that the stamps should be canceled and the letters marked separately, and required that the defendant should do this either himself or by the employment of clerks to be paid by him out of the surplus revenues of his office.

5. Neither the official character of the defendant nor the fact that he turned over to the Government the savings made by the use of the patented invention can shield him against the owner of the patent.

6. The circuit courts have jurisdiction of all questions concerning the title to a patent and the right to recover for infringement of the same under the patent laws of the United States, irrespective of whether the parties to a suit are citizens of the same or different States.

7. Conveyances *pendente lite* do not at all affect the litigation as between the parties to the original controversy unless there are special statutes or circumstances to control; but courts of justice, even courts of law, and especially courts of equity, often protect the rights of the real owners to the fruits of a recovery as against those who are nominal but not real owners whenever their rights may have been acquired.

8. All interests in patents are assignable by an instrument in writing. No particular form is required; but still there must be some operative words expressing at least an intention to assign in order to constitute an assignment.

9. An instrument which makes no allusion to a patent further than to mention a claim for the use of the invention embraced therein cannot act to carry the patent. The fact that it was recorded in the Patent Office cannot make it an instrument of title, but could only complete its effect if it was one.

10. It is not important in equity proceedings for every purpose that all the parties to the controversy should be upon opposite sides in the formal pleadings. It is sufficient that they are citizens of different States on opposite sides of the dispute, although not on opposite sides in the pleadings, for the removal of the case to the Federal courts.

11. An assignment of all property, except such property as is exempt by law from levy and sale under execution, cannot transfer a patent right.

U. S. Circuit Court—District of Rhode Island.

MILLER *et al. vs.* SMITH *et al.*—DESIGN PATENT.

Clifford, J:

1. The introduction in evidence of letters patent affords a *prima facie* presumption that the patentee is the first and original inventor, and is sufficient to entitle the complainants to a decree, unless it is overcome by competent proof of greater weight.

3. Regulations and provisions applicable to the obtaining or prohibition of patents for inventions or discoveries, not inconsistent with the existing patent act, apply to patents for designs, without modification or variation.

3. Exhibits introduced by a party without needful explanation do not deserve and will not receive much consideration.

4. When the defense of want of novelty is made it is the duty of the tribunal, whether court or jury, to give it effect; but such proof or testimony should be weighed with care and never be allowed to prevail where it is unsatisfactory, nor unless its probative force is sufficient to outweigh the *prima facie* presumption arising from the introduction of the patent.

5. In the case of a design as well as a mechanical patent mere delay in applying for a patent will not forfeit the inventor's right to the same or present any bar to a subsequent application, providing the invention had not been in public use or on sale two years before the filing of the application.

6. A patent for a design consisting of letters of the alphabet having a described ornamentation is not bad because it embraces more than one letter.

7. While it is true that the test of infringement in respect to the claim in a design patent is the same as in respect to a mechanical patent, it is not essential to the identity of the design that it should be the same to the eye of an expert.

8. If to the eye of the ordinary purchaser the designs are substantially the same, if the resemblance is such as to deceive such an observer and sufficient to induce him to purchase one supposing it to be the other, the one first patented is infringed by the other.

ABSTRACT.

The record in this case shows that the patent is for an alleged new and useful design for jewelry of the various kinds specified in the description given in the specification. It consists of the letters of the alphabet, shown by photographic illustrations, which are of a rustic pattern ornamented by leaves, the claim being for sleeve buttons and other jewelry, composed of the letters of the alphabet, and having the described ornamentation of letters, substantially as given in the description and shown in the photographic illustration accompanying the application for a patent.

Rustic letters are employed, by which is meant, as the complainants allege, letters in which the necessary lines in the same represent the branches or trunks of trees unstripped of their bark, the ornamentation consisting of several separate leaves placed at intervals upon the lines of each letter, the lines exhibiting the appearance of the bark of a branch or trunk of a tree, which design is used for ornamenting buttons, studs, lockets, and other articles of jewelry. Photographs of the improvement were taken directly from gold sleeve buttons having leaves upon the letters in actual relief as given in the descriptive portion of the specification.

Sufficient appears to show that the complainants were jewelers, and that for a series of years they had been endeavoring to produce an initial letter sleeve button which would be more ornamental and better suited for ladies' wear. Proofs were introduced showing many such experiments and giving a history of the efforts to that end, and an account of the time and expenses incurred for its accomplishment, all of which resulted finally in producing the patented design. Experienced witnesses testify that they know of no other design relating to this class of goods which has been as successful as the subject of the patent in controversy, and the court is convinced that the invention is highly acceptable to the public and profitable to the patentee.

Inventors may, if they can, keep their inventions secret, and if they do it is a mistake to suppose that any delay to apply for a patent will forfeit their right to the same or present any bar to a subsequent application. Nor does any different rule prevail in the case of a design patent. Delay less than for the period of two years constitutes no defense in any case; but the respondents may allege and prove that the invention in question had been in public use or on sale more than two years prior to the application of the party for a patent, and if they allege and prove that defense they are entitled to prevail in the suit. Due allegation in that regard is made in this case; but the record contains no proof to support it, and it must be overruled. From all which it follows that the patent is a good and valid patent, and that the complainants, if they have proved the alleged infringement, are intitled to a decree in their favor for the profits made by the respondents in the violation of their exclusive right to make, use, and vend the improvement secured by the letters patent.

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Both the testimony of the complainants' expert and the comparison of the exhibits made by the court are decisive that the manufacture by the respondents is, in the sense of the patent law, substantially the same as that of the complainants, which shows that the complainants are entitled to an account.

Decree for complainants.

By the Commissioner of Patents.

(*Appeal from the Examiners-in-Chief.*)

MCTAMMANY JR., *vs.* NEEDHAM—AUTOMATIC MUSICAL INSTRUMENTS.

Marble, Commissioner:

1. It is not necessary that an applicant, in order to defeat a patent, should show that he conceived the invention and reduced the same to practice before the time at which such invention was conceived by the patentee.

2. To defeat the rights of a patentee it is sufficient to show "that he had surreptitiously and unjustly obtained the patent for that which was in fact invented by another who was using reasonable diligence in adapting and perfecting the same."

3. Diligence in perfecting an invention is a relative matter, and the law does not require that an inventor who is engaged in developing a number of improvements at the same time should devote all his time and energy to any one at the expense of others.

4. When an applicant has once reduced an invention to practice the question of diligence in applying for a patent is one between him and the public, and can only enter as an element in the question whether the completed invention was abandoned by him to the public.

Destruction of a Lighthouse by an Earthquake.

Telegraphic information has been received at the Hydrographic Office, Admiralty, from the officer commanding the naval forces in the Dutch East Indies, that the stone lighthouse on First Point (Tanjong Koelong), Java, the south point of entrance to the Strait of Sunda, separating Java and Sumatra, has been thrown down by a violent earthquake.

AN IMPROVED TELEPHONE.

The engraving shows an improved form of telephone receiver and transmitter, and a very convenient combination of the two instruments, lately patented by Mr. John P. McDermott, of Galveston, Texas.

The combined instrument is designed to be worn upon the head, as shown in Fig. 1, so that the user may hold telephonic conversation without regard to position, and listen without fatigue or inconvenience to lectures, concerts, etc. This arrangement possesses the advantage of excluding extraneous sounds and of preventing bystanders from hearing what is said in the transmitter. The receiver magnet consists of thin strips of magnetized steel having a U-form and adapted to the head. The ends of the magnet are curved to receive the support for the diaphragms, mouthpieces, and bobbins. The iron cores of the bobbins are inserted in the curved portion of the magnet.

The transmitter is attached to the receivers by a swinging elastic yoke, which renders it adjustable to the mouth of any user and admits of readily removing it from the mouth when not in use. A cloth band passes around the back of the head to hold the apparatus in its proper position. The compound magnet is covered with silk or other suitable material. This covering conceals the primary and secondary wires and protects them from injury.

The transmitter consists of a non-conducting mouthpiece, and a chambered hemispherical block containing two semicircular plates of carbon insulated from each other, and connected by a wire with the two metal pieces forming the yoke which supports the mouthpiece. A plane disk of carbon rests upon the two semicircular carbon plates and is free to vibrate upon them.

The primary current passes through the yoke and through the carbon disk and the two semicircular carbon plates. The variations of contact produced between the three carbon surfaces by the action of sound waves on the carbon disk disturb the primary current, inducing undulatory currents in the secondary wire of the induction coil.

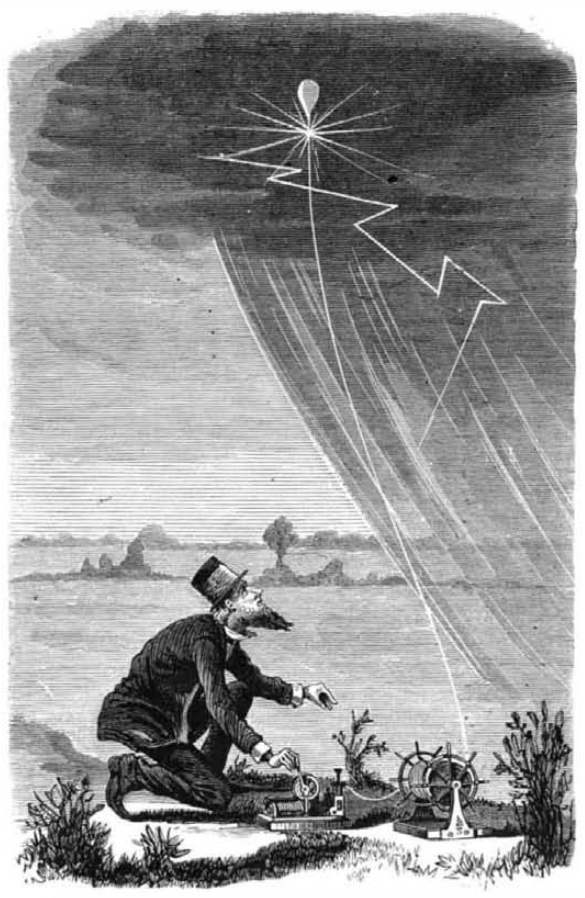
The primary and secondary circuits differ little from the common practice. Mr. McDermott has dispensed with a special call bell magnet, using the magnet of the induction coil for the purpose of operating the bell hammer armature. This arrangement of telephone transmitter and receiver possesses many obvious advantages; for example, it would be very convenient in cases of writing by dictation, or of stenographers recording speeches. Persons may remain at home listening to public addresses, sermons, or concerts, sitting comfortably and listening without the slightest inconvenience.

This invention enables two persons to carry on a conversation as readily as if they were in each other's presence. As the entire apparatus weighs but a few ounces, its weight is not at all noticeable. It is unnecessary to point out the further advantages possessed by this novel arrangement, as they will be apparent to those understanding the requirements of telephonic communication.

McDERMOTT'S TELEPHONE.

NOVEL METHOD OF PRECIPITATING RAINFALLS.

A patent has recently been issued to Daniel Ruggles, of Fredericksburg, Va., for a method of precipitating rain storms, which, judging from a well known precedent, is not entirely chimerical. It has frequently been noticed that heavy cannonading is followed by a fall of rain. Profiting by this suggestion, Mr. Ruggles has invented a method of producing a concussion or a series of concussions in the upper regions of the atmosphere which he believes will induce rain.



PRECIPITATING RAINFALLS BY MEANS OF EXPLOSIVES.

The invention consists in brief of a balloon carrying torpedoes and cartridges charged with such explosives as nitroglycerine, dynamite, gun cotton, gunpowder, or fulminates, and connecting the balloon with an electrical apparatus for exploding the cartridges.

Our engraving represents an individual in the act of bringing down the rain.

Mining in Maine.

In an extended review of the progress and prospects of mining in Maine the *Mining Journal* furnishes the following information with regard to the present condition of the more important mines of that State.

Several of the Blue Hill mines are about to be supplied with smelters. The Sullivan mill is turning out bullion, the Waukeag is in magnificent ore, which grows richer and richer with every additional foot of depth, the Milton at a depth of 160 feet, and the Grant at 100, are on the eve of cutting their respective ledges. Further east, at Goulds-boro, the concentrating mill is about to demonstrate the value of the ores of that section. The mines of the Bagaduce region are, at the slight depth attained, showing ores of wonderful richness and in considerable quantity. The Deer Isle is making regular shipments of ore and, as we have before stated, is now on a paying basis. In the Hampden district the Con. Hampden is cross-cutting for the vein at a depth of 200 feet and will probably reach it within a few days. The Lawrence cross-cut has penetrated the vein, and rumor says that very fine ore is being taken out. Recently active work has been commenced by New York parties at two different points upon the Hampden lode, both lying between the properties of the Con. Hampden and Norombega Mining Companies.

There are many other valuable properties scattered all over the State, but we have mentioned a sufficient number to show that mining matters in Maine are progressing favorably and that the industry is rapidly assuming extensive proportions.

MECHANICAL INVENTIONS.

An improved machine for preparing wood pulp has been patented by Mr. John C. Potter, of Orwell, N. Y. The invention consists in a revolving head fitted with cutters having serrated edges, and combined with a sliding carriage for carrying the log. The cutters act in the direction of the grain of the log to reduce the wood to pulp as the carriage reciprocates back and forth.

Messrs. Edgar C. Hall, of Ione, and Charles D. Smith, of Amador City, Cal., have patented a vise. The object of this invention is to provide a device for securely holding wedge-shaped pieces of iron or other material. The invention consists of a movable vise jaw supported on a ball and socket joint or joints, so that it may have lateral and angular adjustment.

Mr. Genry A. Chapman, of Strawberry Point, Iowa, has patented a simple, strong, and effective tool that serves as a cutter and wrench for pipe and as an ordinary monkey wrench. The tool has a movable reversible jaw whose lower end rests against an adjustable nut, which traverses on the screw-threaded handle of the tool, and whose upper or operating end is held to the shank of the fixed jaw by a yoke, and is adjustable by a set screw in the yoke.

What is a Cold Bath?

The season of the year when very many people who have experienced pleasure and advantage from a daily cold bath have to discontinue the practice is come. Months will elapse before the return of genial weather will allow of their indulgence in what may be termed man's natural stimulant. Among the young and robust there are a large number who are able to bathe even in the depths of winter; the advantage of so doing is, however, questionable. But let it be once well understood what a cold bath really is, and the course by which we can avoid Scylla and Charybdis will be obvious. A cold bath is not necessarily a bath in water of the temperature of the atmosphere. A bath is truly and really cold when it produces a certain physiological effect—a slight momentary shock followed by pleasant and lasting reaction. These effects are for the majority of people most pleasantly obtained by bathing in water about 35° to 40° below the temperature of the body—the usual temperature of unheated water in June and July. Bearing this in mind we can enjoy our physiological "cold" bath as safely and pleasantly at Christmas as at midsummer, and there is no necessity for the most timid or weakly to discontinue his morning tub because the summer weather is over. When the water sinks below a temperature of 60°, let it be heated to that point and then used, and we shall still have our "cold" bath, though of heated water. The daily stimulant effect of such a bath is so beneficial to the great majority of persons and is of such marked service in maintaining health, that it is very important to have it widely known that a cold bath may be taken all the year round, provided cold is not mistaken to mean "at the temperature of the outer air." To heat our bath during the winter months is too often thought to be unmanly, while in reality it is truly scientific, and to bathe in unheated water all the year round, whatever the temperature that water may be, is to prove one's self an ignorant slave of outward circumstances.—*Lancet.*

STEAMSHIPS for whaling service have been in successful use on the Atlantic for several years. The first to invade the northern Pacific, the Mary and Helen, of New Bedford, recently arrived at San Francisco from a successful cruise in the Arctic Ocean. She had taken a full cargo of oil and 45,000 pounds of whalebone, together worth over $100,000, the proceeds of one season's work. The consort of the Mary and Helen left New Bedford for the same fishing grounds last summer.

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STORMY PETREL.

The stormy petrel, known to sailors as the Mother Carey's Chicken, is hated by them after a most illogical manner because it foretells an approaching storm, and therefore by a curious process of reasoning is taken for its cause.

This bird, says "Wood's Natural History," has long been celebrated for the manner in which it passes over the waves, pattering with its webbed feet and flapping its wings so as to keep itself just above the surface. It thus traverses the ocean with wonderful ease, the billows rolling beneath its feet and passing away under the bird without in the least disturbing it. It is mostly on the move in windy weather, because the marine creatures are flung to the surface by the chopping waves and can be easily picked up as the bird pursues its course. It feeds on the little fish, crustaceans, and mollusks which are found in abundance on the surface of the sea, especially on the floating masses of algæ, and will for days keep pace with a ship for the sake of picking up the refuse food thrown overboard. Indeed, to throw the garbage of fish into the sea is a tolerably certain method of attracting these birds, who are sharp-sighted and seldom fail to perceive anything eatable. It is believed that the petrel does not dive. The word petrel is given to the bird on account of its powers of walking on the water, as is related of St. Peter.

It does not frequent land except during the breeding season, and can repose on the surface of the ocean, settling itself just at the mean level of the waves, and rising and falling quietly with the swell. This petrel breeds on the northern coasts of England, laying a white egg in some convenient recess, a rabbit burrow being often employed for the purpose.

Mr. Reid, of Kirkwell, Orkneys, has kindly given the following short but graphic description of these birds while breeding: "They land on our islets every breeding season. I have had them handed to me alive, frequently together with their eggs, and stinking little things they were, as bad, I suppose, as the fulmar."

This bird possesses a singular amount of oil, and has the power of throwing it from the mouth when terrified. It is said that this oil, which is very pure, is collected largely in St. Kilda by catching the bird on its egg, where it sits very closely, and making it disgorge the oil into a vessel. The bird is then released and another taken. The inhabitants of the Faroe Islands make a curious use of this bird when young and very fat, by simply drawing a wick through the body and lighting it at the end which projects from the beak. This unique lamp will burn for a considerable period. Sometimes the petrel appears in flocks, and has been driven southwards by violent storms, some having been shot on the Thames, others in Oxfordshire, and some near Birmingham.

The general color of this bird is sooty black, and the outer edges of the tertials and the upper tail coverts are white. Its length is barely six inches.

STORMY PETREL.—*Thalassidroma Pelagica*

Adulteration of Soaps.

Consumers of soap, says a writer in the *Deutsche Industrie Zeitung*, should not neglect to inform themselves of the real value of the wares they buy, and to prove the absence of intentional adulterations. A very old trick is to increase the weight of soap with water, but as ordinary soap soon loses this by evaporation in the air, this deception will not succeed unless the soap is sold off quickly. There are two other methods of overweighting. One consists in putting in chemicals that are adapted to hold this excess of water in the soap, so that it loses little or nothing in weight by lying. Another way is to add some mineral substances, soluble or insoluble, to increase the weight and diminish proportionally the value of the soap. Artificially increasing the amount of water and adulteration with worthless chemicals pay well, and they do a fine business by duping their customers.

It is no wonder that a housekeeper does not have her toilet soap and family soap analyzed, because she uses comparatively little of it, and is satisfied if it looks good and makes a good suds. When large consumers, however, neglect to submit their soap to an examination they may suffer considerable loss. If soap was tested oftener than it is more frequent complaints would be made public, and better wares would result. There is soap in the market that contains 75 per cent water, and externally cannot be distinguished from soap that contains only 12 per cent. It is easy to see how great a difference there may be in the value of two specimens of the same price. By simply increasing the amount of water doors and gates are open for deception in soap making, so that many manufacturers make a profit of a hundred per cent by selling water instead of soap.

Gelatinous substances are most frequently used to retain the water in soap, and are at the same time an excellent filling. Alumina in the hydrated form performs this service best. The author detected this substance in six samples of soap, which had over 60 per cent water, and were sold by their manufacturers at the same price as another manufacturer sold soap with 24 per cent. Other gelatinous substances, like silica and organic substances, are used. They are easily detected by chipping up the soap and dissolving it in alcohol, in which they are insoluble, while pure soap is perfectly soluble. The undissolved residue may be filtered out and more carefully examined. Hot water will dissolve the gelatinous substances if they are organic, like gelatine or glue, leaving alumina, silica, etc., unaffected. By evaporating the aqueous solution and weighing the residue the quantity of gelatine can be quantitatively determined. The silica and alumina can be dried, then ignited in a platinum or porcelain crucible, and weighed.

Waterglass is frequently added to soap, and, although it is not an injurious ingredient, such soap can be made cheaper, and should be sold as waterglass soap.

In some samples the author found starch, gypsum, chalk, clay, phosphate of lime (bone ash), and barytes, or blanc fixe, as the adulterants. All these can be separated by dissolving the dry soap in alcohol. The alcoholic solution may be evaporated to dryness, dried at 212° Fah., and weighed.

The author found more adulteration in the Berlin soaps than any other; but in the little city of Munster, out of 12 samples from different factories, 5 were adulterated.

The author neglects to mention the fact that impure fats in a state of incipient decomposition are often employed, perfumes being added to disguise the odor.

Crystals of Hæmine.

F. Högyes has examined crystals from the blood of men, oxen, swine, sheep, dogs, cats, rabbits, guinea pigs, mice, pole cats, poultry, pigeons, geese, ducks, *Rana esculenta* and *temporaria*. All have one only crystalline form. They belong to the monoclinar or triclinar system, probably the former.

THERE are now produced from Indian corn millions of pounds of starch and glucose annually, of which a large quantity is exported. These substances carry away no mineral fertilizers; they come entirely from the atmosphere.

Detection of Sulphide of Carbon in Mustard Oil.

An interesting case of supposed adulteration of oil of mustard has recently attracted attention in Germany. A certain firm in Leipsic imported some oil of mustard from Russia, and suspecting that it was adulterated with carbon disulphide submitted it to an examination which resulted in the detection of a considerable amount of that substance, which was distilled off and identified. As the Russian firm could not deny its presence there, they attempted to defend themselves by saying that it was a by-product formed from the mustard seed. The seed used in Russia belong to the variety *Sinapis juncea*, while that used in Germany is *Sinapis nigra*.

Prof. A. W. Hofmann, of Berlin, who may be called the father of mustard oils, was employed as expert. He obtained some of the Russian mustard and prepared 200 grammes of the oil from it. It had all the properties of normal oil of mustard, and on distillation the temperature soon rose to 150°. The oil was tested for carbon disulphide in the usual manner, viz.: the distillate was mixed with absolute alcohol, alcoholic potash added, and heated to boiling. It is then acidified with acetic acid, and a solution of sulphate of copper added. If carbon disulphide is present a yellow precipitate of xanthogenate of copper is formed. Prof. Hofmann failed to detect any in the oil of mustard by this test until he had modified it as follows: 50 grammes of the oil were placed in a flask on a water bath, and the flask provided with a delivery tube that dipped into alcoholic potash. On drawing a current of air slowly through both fluids for a few hours, it was found that the potash gave, after adding acetic acid, the yellow precipitate with copper sulphate. This proved that the oil did contain a trace of the suspected substance, but gave no means of determining its quantity, as the xanthogenate cannot be dried without partial decomposition.

Some seven or eight years ago Prof. Hofmann prepared triethyl-phosphine by the action of hydrogen phosphide on ethyl iodide under pressure. He recollected that it was a very delicate test for carbon disulphide, and resolved to test it now. He put the oil in a tubulated retort on a water bath, and connected the receiver with three wide test tubes containing caustic soda solution on which floated an ethereal solution of triethyl phosphine. On passing a current of dry carbonic acid through the whole apparatus, if carbon disulphide is present, the phosphine solution soon turns rose red, and in a little while pink crystals of $(C_2H_5)_3PCS_2$ are formed. If these crystals are collected on a weighed filter and dried in vacuo, each 100 parts will represent 39·1 of carbon disulphide. Professor Hofmann found that the oil made from Russian mustard contained 0·37 to 0·41 of carbon disulphide; that from black mustard seed 0·56 to 0·51; and artificial oil of mustard from allyl iodide and sulphocyanide of ammonia contained only 0·32 per cent. B. B.

A New System of Grape Culture.

The San Mateo (California) *Journal* says: On the Alpine Ranch, occupied by Charles B. Sears, there is a vineyard of several thousand vines of all descriptions of grapes, foreign and domestic. For six or seven years the vines have been each year, scientifically, as it is called, pruned by cutting back to the traditional two or three buds, and the ground has been regularly plowed and highly cultivated. The vines resisted all this kind treatment and refused to bear well, although making each year a magnificent growth of wood, and showing a very fine healthy stock and root. An experiment was tried with the vineyard this year; a small portion was pruned and cultivated in the usual manner, the larger portion being left entirely unpruned and uncultivated. The result is remarkable. In the latter portion of the vineyard the ground is fairly covered with fine well ripening grapes, making a yield far beyond the ordinary crop of average grapevines, while in the pruned and cultivated portion the vines exhibit but few bunches of perfect grapes.

This great success seems attributable to two causes, chiefly: First, that cultivation and pruning caused too great a growth of wood, thus drawing away from the fruit-bearing tendency; second, the pruning caused the vines to have a high,

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straight stem, thus elevating the fruit from the ground into the cool moist touches of the fogs, at times; while letting the vines run caused them to spread out flat on the ground, and the grapes lying immediately upon the warm earth, and in contact with it, are thus sheltered from the adverse influences operating higher above, and were thus fully developed and ripened.

Citric Acid Again.

It never rains but it pours, seems specially true of inventions and discoveries. Several inventors will produce the same instrument simultaneously, each ignorant of what the other has done. Three or four chemists discovered chloroform independently of each other nearly half a century ago. This seems to be the year for citric acid. In a recent number we described the synthesis of citric acid by Grimaux and Adam, from dichlorhydrine. On the 15th of August Kekulé presented a paper to the Berlin Chemical Society, in which he described a totally different synthesis of the same acid. He set out from malic acid, the acid of unripe apples, but one that has been made artificially too. In 1834, Wislicenus had converted it into acetyl-malic acid by treating diethyl-malate with acetyl chloride. The following formulæ will explain this:

Malic acid.	Diethyl-malate.	Acetyl-malic ether.
$COOH$	$COO(C_2H_5)$	$COO(C_2H_5)$
CH_2	CH_2	CH_2
$CHOH$	$CHOH$	$CHO(C_2H_3O)$
$COOH$	$COO(C_2H_5)$	$COO(C_2H_5)$

The last named ether was dissolved in ordinary ether, and, treated with metallic sodium and monobromo-acetic acid, was allowed to act upon the product. Of course the bromide in the latter combined with the sodium in the former to form bromide of sodium, which separated because it was not soluble in ether. The other product was boiled with alcoholic potash, an operation known as saponification. This formed a potash salt insoluble in ether. From this he made the lead salt, and then set the acid free by passing sulphydric acid into its solution. At the time of his making this communication he had not purified the acid, but its reactions with lime salts were such as to satisfy him that it was in reality citric acid which he had obtained.

Andreoni, an Italian, has also given notice that he is trying to make citric acid from the triethylic ether of malic acid by means of sodium and bromo-acetic ether; a method quite similar to that of Kekulé.

It is somewhat interesting to know that Germany, Italy, and France have each solved this problem together, yet independently. England and America must look to their laurels.

Farming in Japan.

Milton S. Vail, a missionary in Japan, gives, in the *Methodist*, the following account of Japanese farming:

"The farmers in Japan seem to operate on a small scale. All the land belongs to government, and all have to pay a ground rent. Wheat, barley, rye, and buckwheat are grown in rows, the weeds being kept out by hoeing. It seems strange to see all their grain growing in rows, but no doubt good crops are thus produced. Rice is the chief product of Japan. The earth nearly everywhere is black, and the black soil of the valleys, when well cultivated and made to hold the water from the neighboring hills, makes good rice fields. The soil is broken by manual labor. Men go in to the mud up to their knees, and with a long-bladed hoe turn the earth over. Horses are used to harrow it down, and when ready, the rice plants are set out by hand. The rice of Japan is very fine, and the Japanese know how to cook it. With them it is the principal article of food—a little rice, with pickles and tea, often constitutes the meal. The people do not know how to make bread, but seem to be very fond of it when they can get it of foreigners. They have flour which they use in various ways in the simplest kind of cookery. I noticed in coming to this place (Hakone, a mountain town forty-five miles from Yokohama) that at some of the inns, instead of tea, they gave us a drink made of pounded wheat. Potatoes, sweet potatoes, egg plants, corn, melons, cabbages, onions, and turnips are also grown, and other vegetables, the names of which I do not know, and never saw in America. I think all the vegetables grown in New York can be cultivated here. Of fruits, we have peaches, plums, oranges, strawberries, pears, and persimmons, also figs."

The Inventor of the Bell Rope on Trains.

Captain Ayres, whose death at a great age was noted recently, was the inventor of the present bell rope system on railroads. When he commenced running on the New York and Erie Railroad the locomotive had no cab for the engineer—nothing but a framework. There was no way to go over the cars nor for the engineer to communicate with the conductor when the train was in motion. In those days, instead of the conductor running the train, as at present, the engineer had entire charge, and the conductor was a mere collector of fares and tickets. In 1842 Ayres inaugurated a system of signals by a cord running over the cars to the engine, where it was attached to a stick of wood. Ayres' engineer, a Dutchman named Hamill, resented the innovation, cut the stick loose, and the conductor and engineer had a fight at Turner's over the matter, Ayres whipping his engineer badly, and thereafter conductors, and not engineers, have had charge of trains. Soon after the bell rope and gong went into general use.—*Paterson (N. J.) Press.*

THE FAN AS AN OBJECT OF HYGIENE.

Says a French exchange—the *Journal d'Hygiène*—the fan, which is used by women of all countries as an ornamental as well as useful article, has also its utility from a hygienic point of view. This can best be shown by giving a brief *résumé* of the history of fans from remote ages up to the present time. We shall find that, dating from most ancient times, the most diverse nations and races have used them; and that the caprices of fashion, while varying their forms and materials, have never succeeded at any period in throwing them out of universal use.

The papyrus, whose large leaves so long served as a writing material, was one of the first plants from which fans were made. It was in Egypt especially that its leaves were used for this purpose. It is said that the daughter of Pharaoh, who saved Moses from the waters of the Nile, held in her hand, during her walk along the banks of the river, a fan made of this very sedge. We find that in ancient Greece the first fans used were made of branches of myrtle, acacia, and plane tree. On the bass-reliefs and ancient monuments of this country we frequently see processions of bacchants bearing thyrses surrounded with ivy and vine leaves, and which, in addition to their ceremonial character, were designed to fan and shade from the sun the heated votaries of the god Bacchus. It was not till the fifth century before Christ that the peacock was known in Greece. From this epoch dates the use among Grecian ladies of the peacock's tail as a new and elegant kind of fan imported from the shores of Asia Minor, and especially from Phrygia. Euripides, in one of his tragedies, recounts how a Phrygian eunich cooled, according to the custom of his country, the tresses and cheeks of Helen, with a peacock's tail with all its feathers outspread. Dating from that epoch, whenever mention is made of the attire of women, in Greek or Roman authors, fans or peacocks' tails are spoken of. As the art of the fan makers arose the use of feathers alone came to be discarded, as they were found to be too pliable; and hence the artist conceived the happy idea of placing between each feather a thin strip of wood, which not only gave the fans a greater amount of resistance, but also made them more durable.

We frequently find in ancient pictures and on antique vases representations of this very sort of fans; and they are also mentioned in the writings of Ovid and Propertius. The female slaves who were specially employed to carry parasols and fans to shade and drive away the flies from ladies of antiquity when they appeared in public are called by Plautus *flabelliferæ*. In this respect our own modern ladies are much more modest, since they carry their own parasols and suspend their fans by a chain at their side. Fans made of peacock's feathers remained in fashion through the middle ages and up to the seventeenth century, not only in Italy, but also in England and France; but they were rather bouquets of feathers than the fans of our day, although they subserved the same end. In those times, then, peacock's feathers must have been an important article of commerce. In fact, Alexandria and other maritime ports of the Levant shipped to Venice, as well as to other commercial cities of Italy, large quantities of peacock and ostrich feathers, which were prepared in the most ingenious manner and in all possible styles. Soon, however, ostrich feathers came more in favor in fan manufacture, to the exclusion of those of the peacock. Fans of this kind, in all styles, such as were used by Italian ladies of the twelfth, thirteenth, and fourteenth centuries, are to be seen in the pictures of Titian and his brother. Toward the fourteenth or fifteenth century ladies began to wear girdles in the form of golden chains, from which were suspended their keys and other objects. From this arose the fashion still in vogue at the present day, of suspending fans from the belt by means of a small chain. This explains the object of the large ring at the end of the fan handle, which has been handed down from the past. There is a fan in the Museum of the Louvre which once belonged to Catharine de Medicis, that has one of these large rings in the handle.

The inhabitants of Africa and the savages of the shores of the Atlantic make their fans from the leaves of palm trees. In the Dutch possessions of Oceanica, the Malay women make use of the leaves of cocoa palm, pisong, and reeds, instead of fans. In the Indies fans are, as in many other Oriental lands, suspended over the bed, and moved to and fro by means of a cord, by slaves, during the repose of the master or mistress. It is from the East that come those fans made of odoriferous woods, which are calculated to render the air of an apartment oppressive and give one the headache, rather than to make the atmosphere refreshing.

Nowhere has the art of the fan maker been brought to such perfection as at Paris, where the most elegant paintings on tissues of the utmost delicacy give these objects an enormous value, such value being often further enhanced by golden ornaments and settings of precious stones. The present style of folding fan, which is such an improvement over the ancient stiff outspread fan, arose in France.

From what has been said, it will appear that if the fan—even such as it was before modern improvements were made on it—had not been a true article of hygiene it could not have resisted the everchanging caprices of fashion for so many centuries.

ENGINEERING INVENTIONS.

Mr. Burpee R. Starratt, of Truro, Nova Scotia, has patented an improved railroad frog. The absence of the ordinary heavy plates, which compose part of the frogs in common use, gives this frog great advantage, both in weight and cost, and makes it more elastic.

An improvement in high and low water indicators for boilers has been patented by Mr. Florent Ladry, of Brussels, Belgium. The invention consists in a float having only one small pipe extending close to the bottom of float and boiler, to allow the air and steam to circulate freely between the float and boiler, in order to maintain the same pressure on the inside and outside of the float.

Mr. Henry A. Ridley, of Jacksonport, Ark., has patented a spark arrester, which consists of a cone of wire gauze projecting into the smokestack and supported so as to leave an annular space between it and the stack for the escape of cinders, which are received by a cylindrical jacket surrounding the upper end of the stack.

An improvement in paddle-wheels has been patented by Mr. Theodore G. Stritter, of Batesville, Ark. The object of this invention is to lessen the time, labor, and cost in constructing and repairing paddle-wheels, while producing stronger and better wheels. The invention consists in securing the circle braces to the arms of a paddle-wheel by placing metal sockets upon the ends of the braces and attaching the sockets to the arms of the wheel.

Dr. Edward Seguin.

Probably no man ever did so much to put the work of elementary education upon a reasonable and thoroughly scientific basis as Dr. Edward Seguin, who died in this city October 27, in the sixty-ninth year of his age. This, however, without directly attacking the traditional methods of teaching.

Dr. Seguin was educated at the colleges of Auxerre and St. Louis, Paris, and early turned his attention to the education of idiots by physiological training. He established in 1838 the first school for this sort of work, achieving by his marvelous skill and patience results which won him a place in the front rank of the world's benefactors. His school became a model after which seventy-five similar institutions have organized in various countries. The French Revolution of 1848 obliged Dr. Seguin to take refuge in this country, where he spent the next ten years practicing medicine in Ohio. Subsequently he revisited France and then returned to this city. Among his more important works are "Hygiène et Education des Idiots" (1843); "Images Graduées à l'Usage des Enfants Arrières et Idiots;" "Traitement Moral Hygiène et Education des Idiots et des autres Enfants Arrières" (1846); "J. R. Pereire, Primier Instituteur des Sourds et Muets en France" (1847); "Historical Notice of the Origin and Progress of the Treatment of Idiots," translated by Dr. J. S. Newberry (1852); "Idiocy and its Treatment by the Physiological Method" (1866); "New Facts and Remarks Concerning Idiocy" (1870); "Medical Thermometry" (1871); "Prescription and Clinic Records" (1865–77); "Mathematical Tables of Vital Signs" (1865–77); "Thermomètres Physiologiques, Manual of Thermometry for Mothers, Nurses, Teachers, etc." (1873); "Official Report on Education at the Vienna Exhibition of 1873," published in 1875. Among his later essays, "The Physiological Training of the Idiot Hand" is perhaps the most valuable.

Captain R. F. Loper.

Captain R. F. Loper, for many years a prominent inventor and shipbuilder, died recently in Brooklyn. After a long and successful career as a seafarer, Captain Loper settled in Philadelphia and turned his attention to shipbuilding. Between 1847 and 1866 he constructed about four hundred vessels, among the largest being the steamship Lewis, for the Boston and Liverpool Steamship Company; the Star of the South, ten steamships for the Parker Vein Company, and the California, for the Newfoundland Telegraph Company. He also designed and constructed some fast yachts. Captain Loper was the owner of several patent rights, including the Loper propeller engine, propeller boiler, and a patent for constructing a ship so as to prevent decay of her timbers for a long period of time. During the Mexican War Captain Loper built in thirty days 150 surf boats, in which the American troops were landed at Vera Cruz. The naval officials estimated that it would take ninety days to build these boats, but on Captain Loper being consulted he agreed to furnish them in thirty days. Had the time for constructing them been as long as ninety days, General Scott would, in all probability, have been obliged to postpone his expedition against Vera Cruz until the following year. During the late war Captain Loper's services as Assistant Agent of the War Department were of signal value, and were characterized by the well-directed energy and practical success which marked his whole career.

Col. E. L. Drake.

Col. E. L. Drake, the first to sink a well in Pennsylvania for oil, and the pioneer in the petroleum business in that State, died at his home in New Bethlehem, Pa., November 7. The first well was bored in July and August, 1859. Having lost the fortune made by his earlier ventures, Col. Drake was granted in 1864 an annual pension of $1,500 by the State he had done so much to enrich. A statue to his memory is about to be erected in Titusville.

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Philadelphia's Elevated Railways.

Reporting the progress of the work on the Pennsylvania Elevated Railway, the Philadelphia *Public Ledger* says that from Sixteenth street west to Twentieth, along Filbert street, the twelve arches in each square, as well as those over the cross streets, have been finished and are ready for the rails, while from Twentieth to Shoch street, to the abutment half way between the former and Twenty-first street, there are eight arches also ready for tracks. From Shoch street west nearly to Twenty-fourth street, nothing has been done yet beyond building the foundation for the iron columns intended to support the trestle work along the middle of Filbert street, but it will not be long before the superstructure is in place, as it has been completed eastward nearly half way to Twenty-third street. At this point workmen are now engaged, by means of an immense traveling derrick running upon a portable railway on each side of the street, in hoisting the columns into place, when they are screwed at the bottoms to iron bed plates, and afterward connected with the upper work forming the roadway by rods and stays. From the made ground or embankment forming the approach to the bridge over Thirtieth street, west of the Schuylkill, and over the bridge across the river, continuing east nearly to Twenty-third street, the iron roadway has been built, and it will not be long before it will be carried eastward to the abutment of the solid roadway on the company's property between Twentieth and Twenty-first streets. The delay so far in the progress of the work is said to have been caused by difficulty in obtaining the iron for the trestle work.

The buildings on the square bounded by Merrick, Filbert, Market, and Fifteenth streets, have all been demolished except two on Merrick street and those along Market street, and on the vacant portion preparations have been made for building the new general passenger station of the company, with restaurant, waiting rooms, offices, etc. The foundations are now being laid along Filbert and Fifteenth streets, and from their substantial character the solidity of the building may be inferred. That portion of the depot between Fifteenth and Sixteenth streets is up one story, at which height the tracks are supported by heavy iron girders resting upon thick iron columns throughout the building, and by the walls of the structure on its eastern and western fronts. It is said a new depot is to be erected at Powelton avenue to accommodate the citizens of West Philadelphia, when the general passenger business, now done at Thirty-second and Market streets, will be transferred to the Fifteenth street depot.

The company are building a large semicircular engine house for passenger locomotives on the west side of their property below Spring Garden street bridge, an immense mass of solid masonry forming the back walls of the building and the retaining wall of the street to the rear. At the sides of the proposed site blasting is going on to remove the rocks which obstruct the progress of the work in those directions. The building will have nineteen tracks, and be capable of housing that number of engines, whose movements will be facilitated by a large turn-table in the center, already in its place in the well built for it. The time for the full operation of the elevated road is set down as the beginning of April.

A Novel Method of Masking Prints.

At the last meeting of the Photographic Society of Toulouse M. Pelegry brought forward a proof representing the Pic du Midi, of Ottau, and the negative which produced this proof.

In the negative the mountain in the background is completely solarized, and by ordinary printing can only produce a proof in which the foreground will be perfectly black if the slightest trace of the mountain is to be obtained. Nevertheless, in the proof shown the mountain is well brought out without the foreground being black, and the negative is untouched.

This result may be obtained by the following process: A rough paper cutting is made of that part of the negative which is to be protected, leaving uncovered the sky, the mountain, and, in fact, all those parts whose development is to be aided. This paper is fixed upon a transparent plate—for instance, the glass of a printing frame. The plate thus partly covered is placed on a chair facing the sun; on another chair, with its back to the sun, is placed the printing frame containing the negative and the sensitive paper. The sunlight reflected from the uncovered part of the glass is made to coincide with those parts of the negative which require to be favored. A much stronger light thus falls upon them than on the rest of the negative, which only receives a diffused light. It will be necessary from time to time to regulate the position of the frame containing the negative, so that the reflected light may continue to fall on the desired spot. To avoid the necessity of constant change the frame may be put slightly in advance of the exact point, and left until it is a little behind it.

If a certain distance—say two yards—be left between the chairs, the transition from that part lightened by the reflected light and that which is not will be perfectly gradual, leaving no hard line on the proof. The chairs may be brought nearer or separated according as a greater or less softening is desired. When the parts lightened by the sunlight have almost reached the required intensity the whole may be brought into ordinary light, or to the sun, to finish the proof.

If the light were reflected by a plated glass the transition from the shadow to the reflected light would be sharper, yet without being too hard, since the light would be refracted by the thickness of the glass, besides being reflected by the two surfaces. The more delicate operations might be carried out in this way.—*Le Moniteur.*

[Science.]

The Comets.

There are now four comets visible with a good telescope, but none of them can be seen with the naked eye. They are all growing fainter, and after a few weeks they will become invisible, even in the most powerful telescopes.

The first is the one discovered by Mr. Schærbele at Ann Arbor, Michigan. This is in the morning sky, and its position for November 4 will be:

A. R. = 5h. 18·9m. Decl. South = 7° 33′.

The second is the one discovered by Mr. Hartwig, at Strasburg, Germany; and also, independently, on the next night by Professor Harrington, of Ann Arbor, Michigan. The position of this comet on November 2 will be:

A. R. = 18h. 21·7m. Decl. North = 9° 59′.

It is thought by Professor Winnecke that this comet is a return of the one of 1506.

The third is the comet discovered by Mr. Lewis Swift, at Rochester, New York, on October 10. This is a faint object, and its position on November 2 will be nearly as follows:

A. R. = 22h. 0·0m. Decl. North=34° 15′.

No orbit of this comet has been computed.

The fourth comet is the one with a period of seven and a third years, and known as Faye's, having been discovered by M. Faye, of Paris, in 1843. The orbit of this comet has been investigated in an admirable manner by Professor Axel Moeller, of Lund, Sweden, and its motion is nearly as well known as that of a planet. The ephemeris furnished by Professor Moeller for the present return is almost exactly correct. The position of this comet for November 2 will be:

A. R. = 22h. 53·5m. Decl. South = 0° 25′.

Since this comet is always at a great distance from the sun, it is a faint object, even on the most favorable occasions. It will soon be invisible except in the larger telescopes.

A. HALL.

Washington, October 28, 1880.

Amusing Mathematical Quid Nunc.

Let one who propounds and understands the problem tell a third person to write down any number, large or small (if a large number the problem will seem more remarkable), without letting him see or know what the number is; write this same number backward—*i. e.*, make the last figure the first, the next to the last the second, etc.; subtract the lesser from the greater, multiply the difference by any number whatever;* rub out any figure in the multiple, and (provided the figure is not 0) add together the remaining figures as if they were all units, and tell what is their sum, then the first person will be able to tell what was the figure rubbed out.

Explanation.—The difference between any number and the same written backward will always be a multiple of 9; of course multiplying this difference by any number whatever does not alter this condition. The sum obtained will still be a multiple of 9; for instance, if the sum so multiplied is 7 times 9 (or 63) and is multiplied by 12, it will be 84 times 9 (or 756). The figures expressing any multiple of 9, if added together as units, will always be 9 or some multiple of 9. If one be rubbed out, the sum of the remainder will be so much less than a multiple of 9, thus: if the sum of the remaining figures are 56 the figure rubbed out was 7, that being what is required to make 63, the next multiple of 9.

The reason for excluding 0 from the figures rubbed out is, that if 0 or 9 be erased the remainder will still be a certain number of 9s, and the person propounding the problem cannot tell whether 0 or 9 was rubbed out; but if 0 be excluded of course the figure rubbed out was 9 (for it must be 0 or 9). If the sum given, after rubbing out one of the figures, be 725, 7 and 2 and 5 are 14, and 4 is wanting to make it the next multiple of 9 (18), which was the figure rubbed out.

W. B. W.

Poisoning by Homeopathic Granules.

Dr. Gaspar Griswold, of New York city, gives in the *Medical Record* an account of a supposed case of paralysis which he was recently called upon to attend, but which turned out to be a case of poisoning from homeopathic granules of "nux," which the patient had taken for sick headache. When threatened with the latter complaint the young lady had been in the habit of prescribing these granules for herself. The dose had originally been five of the pellets, taken two or three times; but that morning feeling very badly, and fearing that the medicine might have lost its strength by having been kept for a year or so, she increased the dose to fourteen, and took it five times—seventy granules in all, in the course of an hour and a half. This occurred about an hour before the alarming symptoms exhibited themselves. She had for the time forgotten that she had taken the medicine, not dreaming that it was the cause of her sickness, and, indeed, considering that "homeopathic medicine was in any case harmless, since it affected merely the disease and not the patient." By the prompt application of such antidotes as are used in strychnine poisoning the patient's life was saved. Dr. Griswold was unable to ascertain the strength of the granules, but one of them which he allowed to dissolve in his mouth had a distinctly bitter taste; and the symptoms exhibited by the patient attested "the presence of a larger proportion of the original drug (nux vomica) than is sustained by any tenet which survives the visionary Hahnemann."

*Or the process may be increased by dividing by any exact factor of the last multiplier (thus making the result apparently more complicated). The explanation is that this multiplication and division is merely tantamount to multiplication by the other factor, and does not change the character of being a multiple of 9. Any other operation (before rubbing out a figure) that does not change that proportion may be added, for instance, subtracting or adding any multiple of 9.

Synthesis of Alcohol.

Writing to *La Nature*, M. E. Lapeyière says: In the porous vessel of a small size Bunsen cell, I replaced the nitric acid by a concentrated solution of very pure crystallizable acetic acid; the external compartment containing very dilute sulphuric acid. I then short-circuited the cell, and left it in action during a certain period (from April 29 to May 27). At the end of this period, the acetic acid had disappeared from the porous cell; being replaced by alcohol in sufficient quantity to allow of my obtaining a few grammes of this substance by distillation. As I had foreseen, the acetic acid assimilated the hydrogen necessary for the production of alcohol. M. Lapeyière found by a further experiment that the acetic acid was first converted into aldehyde, and afterward, by a further absorption of hydrogen, into alcohol, the successive changes being expressed by the following equations, in the equivalent notation:

1. $C_4H_4O_4 + 2\,H = C_4H_4O_2 + 2\,HO$;
2. $C_4H_4O_2 + 2\,H = C_4H_6O_2$.

Manufacture of Phosphoric Acid.

A new method of preparing phosphoric acid from natural phosphates has been devised by Albert Colson. It possesses a decided advantage over the old method where phosphates are employed which contain much iron and alumina. The natural mineral is dissolved in dilute hydrochloric acid. After standing twenty-four hours the clear liquid is drawn off, and the insoluble residue washed with water, which afterward serves to dilute the next portion of acid. The clear liquid is treated with sufficient sulphuric acid of 50° B. to precipitate all the lime in it. This liberates the phosphoric acid, so that the mixture now contains hydrochloric and dilute phosphoric acids and sulphate of lime. It is now subjected to pressure to separate the lime from the acid liquid. The latter is concentrated by boiling, the hydrochloric acid being condensed in coke towers.

The acid liquid thus obtained contains 400 to 500 grammes of anhydrous phosphoric acid per liter, and 40 to 100 grammes of hydrochloric acid.

The less lime the mineral contains the more advantageous, because less sulphuric acid is needed to precipitate it, and there is less loss of the other acid, too, for however much the lime is expressed it always retains a certain quantity of the acid liquid.

The phosphate can be dissolved in hydrochloric acid in wooden vats at ordinary temperatures. The silicious and argillaceous residue is easily washed and does not retain over 0·4 per cent of phosphoric acid. After the sulphuric acid is added it should be left quite a long time, because otherwise the precipitation is not complete. The concentration takes place in a retort built of refractory bricks covered with pulverized asbestos and water glass.

Preservation of Tomatoes.

The following description of the process of canning tomatoes occurs in a letter from Mr. Sharples, of Boston, Mass., published in the October number of the *Analyst:*

"The tomatoes are raised in the surrounding country here—chiefly in Arlington and Belmont, which lie about six or seven miles northwest of Boston. The kind preferred at present are known as the Boston Market; these are a smooth, compact tomato, weighing from 150 to 200 grammes; they are very solid, being well filled with meat and very few seeds. These are brought in daily and sold to the factories. At the factory they are emptied, a bushel at a time, into a wire basket, and then scalded by dipping into a tank of boiling water. They are then removed to a large table, when they are sorted into firsts and seconds only, the ripest being packed as firsts. They are then measured out into pails holding about a peck each, and passed on to the skinners, who carefully skin and core them. They are then ready for packing. The cans are filled by hand, the tomatoes being packed as closely as possible into the can. It is found at this stage of the operation that the juice is present in excess and a considerable portion of it is thrown away. No water is ever used, as the tomatoes furnish more than enough.* After the cans are filled to within an eighth of an inch of the top, the lid is placed upon them and soldered fast. A small hole is then punched in it, and the cans are placed in a hot bath until steam issues from the hole: they are then removed from the bath and allowed to cool slightly and sealed; they are then returned to another bath in which they are boiled from thirty to forty-five minutes; from this bath they are removed to a cooling room. Next morning, when cooled, they are stacked. At the end of the packing season the cans are examined, and those which have spoiled are rejected. The condition of a can can almost always be told from an examination of the outside. A can in good order has the ends concave. If, on the other hand, the ends are convex, it is almost certain that the can is spoiled."

*A perfectly ripe tomato, skinned and cored, weighed 127·5 grammes. On drying it left a residue weighing only 7 grammes, or 5·49 per cent of the original weight.

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Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

☞ *The publishers of this paper guarantee to advertisers a circulation of not less than 50,000 copies every weekly issue.*

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R. J. Chard, Sole Proprietor, 6 Burling Slip, New York.

Wanted—Small Clean Brass Castings, 300 to 500 lb. weekly. Foundries address "Cash," Box 773, N. Y. city.

No. 4 Blaisdell Drill, good as new, Bolt Cutter, several Second-hand Lathes, Engines, and Boilers, for sale by Wm. M. Hawes, Fall River, Mass.

The Inventors' Institute, New York, has removed to the Cooper Union Building. Sales of Patent Rights negotiated and Inventions exhibited for subscribers. Send for circular.

Fragrant Vanity Fair Tobacco and Cigarettes. 7 First Prize Medals—Vienna, 1873; Philadelphia, 1876; Paris, 1878; Sydney, 1879—awarded Wm. S. Kimball & Co., Rochester, N. Y.

The most durable and economical protective coatings in the world for tin roofs, exposed brick walls, etc., are H. W. Johns' Asbestos Roof Paints. They are prepared ready for use in six standard colors, and owing to their wonderful covering properties, cost the consumer no more than the cheap articles commonly used. They are for sale everywhere. Samples and price lists will be sent free by the H. W. Johns M'f'g Co., sole manufacturers of genuine Asbestos materials, 87 Maiden Lane, New York.

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Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

Jenkins' Patent Gauge Cock; best in use. Illustrated circular free. A. W. Cadman & Co., Pittsburg, Pa.

Mr. Ely, of Afton, N. J., cut thirteen acres of heavy grass in five hours, July 2, with the Eureka Mowing Machine. It is the best mower made. Farmers send for illustrated circular to Eureka Mower Co., Towanda, Pa.

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The Tools, Fixtures, and Patterns of the Taunton Foundry and Machine Company for sale, by the George Place Machinery Agency, 121 Chambers St., New York.

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Collection of Ornaments.—A book containing over 1,000 different designs, such as crests, coats of arms, vignettes, scrolls, corners, borders, etc., sent on receipt of $2. Palm & Fechteler, 403 Broadway, New York city.

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Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co., 52 Dey St., N.Y.

Recipes and Information on all Industrial Processes. Park Benjamin's Expert Office, 50 Astor House, N. Y.

For the best Stave, Barrel, Keg, and Hogshead Machinery, address H. A. Crossley, Cleveland, Ohio.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Gun Powder Pile Drivers. Thos. Shaw, 915 Ridge Avenue, Philadelphia, Pa.

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Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

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Eclipse Portable Engine. See illustrated adv., p. 317.

The Student's Illustrated Guide to Practical Draughting. By T. P. Pemberton. Sent on receipt of price, one dollar. Address T. P. Pemberton, 5 Dey St., Room 13, New York.

National Institute of Steam and Mechanical Engineering, Bridgeport, Conn. Blast Furnace Construction and Management. The metallurgy of iron and steel. Practical Instruction in Steam Engineering, and a good situation when competent. Send for pamphlet.

Horizontal Steam Engines and Boilers of best construction. Atlantic Steam Engine Works, Brooklyn, N.Y.

Peck's Patent Drop Press. See adv., page 333.

Reed's Sectional Covering for steam surfaces; any one can apply it; can be removed and replaced without injury. J. A. Locke, Agt., 32 Cortlandt St., N. Y.

For Yale Mills and Engines, see page 316.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 301.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor. Stiles & Co., Riegelsville, N.J.

Clark Rubber Wheels adv. See page 317.

Apply to J. H. Blaisdell for all kinds of Wood and Iron Working Machinery. 107 Liberty St., New York. Send for illustrated catalogue.

Blake "Lion and Eagle" Imp'd Crusher. See p. 333.

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4 to 40 H. P. Steam Engines. See adv. p. 317.

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Air Compressors. Clayton Stm. Pump W'ks, Bk'lyn, N.Y.

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Houston's Four-Sided Moulder. See adv., page 332.

Magic Lanterns, Stereopticons, and Views of all kinds and prices for public exhibitions. A profitable business for a person with small capital. Also lanterns for home amusement, etc. Send stamp for 116 page catalogue to McAllister, M'f'g Optician, 49 Nassau St., New York.

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Wanted—A First-class, Second-hand Planer, 42″ x 42″, to plane 16′ to 18′. Give full description. Noble & Hall, Erie, Pa.

New Economizer Portable Engine. See illus. adv. p. 332.

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Saw Mill Machinery. Stearns Mfg. Co. See p. 333.

Ore Breaker, Crusher, and Pulverizer. Smaller sizes run by horse power. See p. 333. Totten & Co., Pittsburg.

Vacuum Cylinder Oils. See adv., page 333.

Lightning Screw Plates and Labor-saving Tools. p. 333.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

(1) M. asks how many horse power can be obtained from an engine with cylinder 8 inches in diameter by 11 in length, working 70 strokes per minute, and supplied with steam at a pressure of 60 pounds. A. With 60 lbs. pressure of steam in the boiler, probably from 10 to 12 horse power. See SUPPLEMENT, 253, for rules for calculating horse power of engines.

(2) W. C. G. writes: I have always been led to suppose the atmospheric pressure to be 15 lb. to the square inch. How does it come that the vacuum gauge shows 30 lb.? A. It is 30 inches of mercury; not 30 lb. pressure, as you suppose. With the mercury column gauge 2 inches height of column is equal 1 lb. pressure nearly, hence a 30 inch column is only equal to 1 lb.

(3) R. S. asks: In what way do yacht engines, going at a speed of twenty-six miles an hour, gain their speed? Is it by gearing or direct action, and what sized engine would it take to run a boat 35 x 8 feet at that speed? A. The speed you mention is one which has not been attained fairly through the water. In these high-speed yachts everything else is sacrificed to speed. No power you could put in your boat (35 x 8 feet) would give it a speed of twenty-six miles per hour.

(4) G. C. writes: We have under construction a pair of compound engines; the sizes of cylinders are, two 8 inches by 10 inches, and two 16 inches by 10 inches, for a yacht which we are now having built. We purpose using a keel or pipe condenser, and, under the circumstances, the pump will be about 10 inches above the condenser pipe. What we want to ask you is as follows: 1. Can a single acting pump with discharge valve (Corliss style) clear the pipe from water? A. Yes. 2. If a foot valve should be placed just below the pump would it assist in emptying the pipe? Is a foot valve under the circumstances absolutely necessary? A. A foot valve is necessary in your case. 3. The size of our pump is 7 inches diameter by 2 inch stroke, is it large enough? A. Not half large enough. Make it 5 inch to 6 inch stroke.

(5) F. C. S. writes: We are running a double set of machinery such as is generally used in a shoe manufactory, also an elevator, with an engine 6x14, making 120 revolutions at 60 lb. of steam. Now we propose to add on nearly as much again machinery with the same engine, by increasing its speed to 170, and carry 70 lb. of steam. Is it practicable? A. Yes.

(6) S. McC. writes: I am building an engine for a small steam yacht (similar to the Black Hawk, No. 14, SCIENTIFIC AMERICAN SUPPLEMENT), 4 inch bore by 4½ stroke. What size steam ports and feed pipe would you recommend to get the greatest possible speed? A. Steam ports ⅜ inch by 3¼ inch; exhaust ports ⅝ inch by 3¼ inch. A feed pipe ¾ inch diameter will be ample.

(7) S. A. H. asks: What is the best arrangement of carburetor to be used in machine formaking gas from benzine? Have tried filling a vessel with cotton and saturating with benzine (80°), and forcing air through it, but the cotton packs so solid in short time that the air won't permeate it. A. Use Sisal hemp instead of cotton.

(8) C. E. K. asks: 1. Is it possible for any individuals to be so charged with electricity (naturally) that, by approaching a finger to a gas jet, a spark will be emitted from the finger of sufficient strength to ignite the gas? A man of good authority says he witnessed such a perfomance in Denver. A. The human body is not a generator of high tension electricity, but it frequently becomes charged with it by the friction of the shoes on the carpet when the conditions are favorable. It is not at all uncommon to light the gas with an electric spark from the tips of the fingers, after walking over the carpet, and it may be done in the winter in almost any house heated by a furnace, provided the atmosphere is in a favorable state. 2. Is there any book of designs for amateur turners in wood and metals? A. Yes; you should write the booksellers and dealers in scroll saws and lathes who advertise in our columns.

(9) S. D. W. asks: 1. Does the alarm or whistling buoy give out its warning in a dead calm and smooth sea? A. Yes. 2. From where does it derive its power? A. The buoy has a constant rising and falling motion from the swell when there is no sea.

(10) W. H. K. writes: 1. I intend building a steam yacht (Sharpie model) 15 feet long, 4¼ feet beam amidships, 2 feet in depth. Please give me the dimensions of the boiler, cylinder, stroke. A. Engine 2½ inches cylinder by 4 inch stroke; boiler 20 inches diameter by 34 inches high, with 1¼ inch tubes; propeller 18 inches to 20 inches diameter. 2. Do you think the boiler for a steam yacht, described in SCIENTIFIC AMERICAN SUPPLEMENT, No 182, is perfectly safe? A. If well made, yes. 3. Can I build a good canoe or row boat with the sides exactly perpendicular, and at a right angle with the bottom? A. Yes, if you give beam enough so that the boat is not crank. 4. Please give give me a cheap method of waterproofing tent drilling A. See SCIENTIFIC AMERICAN, Vol. 39, p. 331 (9). 5. What is meant by 8 oz. canvas, 10 oz., etc.? A. Weight per yard. 6. Where can I obtain a book on canoe building? A. We know of no work specially devoted to this subject. Consult back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT. 7. Can I build a folding canvas canoe, and where can I obtain the plans, etc.? A. There have been several patents taken out for folding canvas boats. Several of them have been described in the SCIENTIFIC AMERICAN. You can obtain copies of the patents at the usual rates.

(11) J. B. S. asks: How can I melt pure gum rubber? A. You cannot melt it without partial decomposition. It may be softened by a moderate heat or by hot water so as to admit of moulding.

(12) C. W. J. asks for a sure and simple cure for warts. A. Touch the warts daily with nitric acid. It is said that they soon disappear under this treatment.

(13) H. A. H. asks: What preparation other than emery can be used to remove rust stains in the barrels of a breech loading gun? It has been proven that the too frequent use of emery alters the pattern. A. Dilute sulphuric acid will remove rust but will not render the surface smooth, and it will probably alter the "pattern" as quickly as emery. Better protect the barrel against rust.

(14) H. B. P. writes: A friend and myself are building a small launch engine of the following size: Cylinder 2⅞ inches, by 5 inches, steam pressure in boiler, 110 lb. to square inch; number of revolutions of screw per minute, about 220. Please inform me: 1. What sized boiler we would require? A. A vertical tubular boiler, about 18 inches diameter and 34 inches height. 2. What sized boat the engine would drive? A. 15 feet or 16 feet in length and 48 to 50 inches beam. 3. What would be the diameter and pitch of screw? A. Propeller 18 inches diameter and 30 to 34 inch pitch.

(15) H. B. B. asks for a metal or alloy that can be easily melted on a common kitchen stove, that will cast readily, stand friction tolerably well, and will not be expensive. A. Use type metal (old type). 2. Out of which paper, the SCIENTIFIC AMERICAN or its SUPPLEMENT, can I get the more mechanical knowledge and information generally? A. Every scientific student and mechanic should have both papers. After subscribing for both we think you will not dispense with either of them. 3. Everything being equal, which will go the faster and be more economical, a boat furnished with side wheels or a propeller? A. In a large boat with light draught, side wheels; in a very small boat, or very deep or changeable draught, screw propeller.

(16) G. W. L. writes: I bought a second hand engine and boiler. It is a locomotive boiler; the engine is horizontal. Not having any force pump to test it with, I filled it full with cold water, then fired it up until gauge showed 73 lb. Now, I would like to know whether you think it would be safe to carry fifty pounds steam pressure? A. We could not say without an examination of the boiler. 2. Could I make a foundation of concrete for engine, and would it be as cheap as one of stone or brick, and could I make foundation of concrete myself; if so, how is concrete made? Engine is nine by twelve inch cylinder. A. You would probably fail with concrete foundation. Use brick or stone. 3. The steam gauge I got with old boiler I put on another boiler to try it with steam gauge on boiler. When the steam gauge used regular on boiler indicated fifteen pounds pressure, the other would only indicate one pound; then when the steam gauge used regular indicated seventy pounds pressure, the other only indicated fifty pounds. I would like to know the cause of it, if I am not asking too much. A. It is evident one or both your gauges need correcting. You should have them tested.

(17) F. G. writes: I have been greatly interested by an article entitled "Value of Swamp Muck," contained in No. 5, Vol. 43, of the SCIENTIFIC AMERICAN. Please tell me in what shape nitrogen can be sold, and by what process it can be brought to that shape. A. Nitrogen alone has no commercial value. Its proportion in the fertilizer merely serves as an index of the richness of the latter in substances which yield, in the process of decomposition, ammonia or ammoniacal compounds, readily assimilated by the vegetable or plant. 2. I have a cellar dug in soft wet soil. I intend to arch it with cement mixed with sand and crushed shells. What should be the proportion of the mixture? A. You will find full directions for mixing cements in SUPPLEMENT 123. 3. What radius would you consider safe for the arch? A. It would be impossible to say without knowing the size and proportions of the cellar.

(18) G. R. F. writes: I want to make a railroad to run a quantity of stone a distance of about a quarter of a mile, to build a pier. I have heard that there are wooden roads in the United States doing good work. Would hard wood rails, without iron facings, answer for such a purpose, to use ordinary railroad wagon wheels, and carry a load of, say, two tons? A. Yes, such roads are in successful use at mines in the northern part of this State; but the load must be governed by the character of the timber.

(19) L. B. C. asks: Would the upper pipe from a waterback in a stove carried up stairs and attached to a coil and then returned to the boiler below give out enough heat to make a room comfortable in winter, and would it obstruct the circulation enough to cause a cracking sound in the pipes? We learn hot water is being used for heating buildings in New York. Cannot the steam and hot water in the ordinary copper boiler generally used be utilized as above stated? A. A small room may be heated in this way, but the trade should not recommend it, as it is not possible to warm a room from the same waterback and keep the water in the boiler as hot as before. If the room is of more importance than the boiler, take the pipe first to the coil, and the return from the coil to the boiler; but if you wish to get the hottest water at the boiler, take the connection for the coil from the top of the boiler and return to the bottom. The pipe from the back, or boiler to the coil, should rise as directly as possible to the highest point of the coil, at which point an air cock should be placed, thence gradually descend through the pipes to the return. The rising pipe should be covered, so as to prevent loss of heat until the water gets to its greatest height.

(20) "Ventilator" asks for the best method of ventilating an office. We have tried several ways, but they all cause the inmates to take cold. A. If the air admitted through the ventilator is in such abundance as to cause a draught, it should be remedied, but we think the trouble lies with the position the heating apparatus (coils, stove, or register) occupies in a room. When the source of heat in a room is in the center, or against the rear or inner (partition) walls, the natural course of the currents of air in that room are up at the heater and down at the coldest sides of the room, and especially in front of the windows; from thence it flows along the floor to the heater again, and any one in this return cold current is apt to take cold. If your outside walls are plastered on the bricks, have them fired and replastered, and heat with a long coil, run the length of the outside walls.

(21) T. H. S. writes: 1. I have a factory the rooms of which are 100 feet long and 70 feet wide and 14 feet high, fitted with double windows, which I purpose heating with 2 inch wrought iron pipes suspended in the rooms and supplied with steam from the boiler. Can you inform me how many rows of pipe will be required? Give the number of square feet of heating surface required for 100 cubic feet of air space. A. Allow from one-half to three-fourths of a square foot of pipe surface to each square foot of glass in the windows. For more data on this question, see SCIENTIFIC AMERICAN, January 17, 1880, page 39. 2. Can a room of same size as the foregoing, which is below the level of the boiler, be satisfactorily heated by hot water so as to avoid wasting the condensed water, or, if heated by steam, is there any means by which the condensed water can be returned to the boiler without pumping? A. Any of the direct-return steam traps will return the water from below the water line into the boiler without the help of a pump, if the main distributing steam pipes are large enough.

(22) E. W. L. asks for a receipt for a preparation that will prevent iron rust on bottom of aquarium tanks? Have used asphaltum varnish, but same wears off in a short time. A. Good asphaltum varnish is about the best thing.

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(23) M. R. asks: Which of two engines will give most power: one of two cylinders, 3 inches diameter, 4½ inch stroke; or one of one cylinder, 3 inches diameter, 9 inch stroke? How much power will I get from either of above, 40 lb. steam, 75 revolutions per minute? A. The power, under similar conditions, would be the same with 40 lb. average piston pressure and 75 revolutions—¾ to ⅞ horse power.

(24) D. M. S. asks: What is proper size for steam pipe leading from boiler with 90 lb. steam, to engine, cylinder 16x36, placed 10 feet away? Should it be as large as 4 inches diameter, and will it do to be not more than 2½ inches diameter? A. It should not be less than 4 inches. 2. What size should pulley be on Judson governor: valve is 4½ inches diameter, pulley on mainshaft is 12 inches diameter; it belongs to above engine? A. Cannot say, as you do not give the speed at which either engine or governor is to run, nor the dimensions of the governor. You should write the maker of the governor, or determine the proper speed by experiment.

(25) H. S. M. writes: 1. Suppose a gun barrel doubled in length without breech pin; put a charge of powder in the middle, and a ball on each side of it, to be driven in opposite directions; fire the charge; would the effect of each ball be equal to one fired from an ordinary gun with same charge of powder? A. You must suppose the conditions perfectly equalized, that the powder has equal effect on both balls. The sum of the effect on the two balls would equal that on one ball when the whole force of the powder was acting by one only. 2. If not, how is the principle of action and reaction being equal sustained? A. The principle of action and reaction is not affected by the result.

(26) C. B. W. asks how the oxychloride of zinc cement is mixed by dentists and used, what proportion of the ingredients is used, and how to obviate the disagreeable taste that zinc chloride produces? In what manner should the cement be introduced into cavities? A. That in most general use for ordinary plugging is composed of oxide of zinc, 5; silex, 2; borax, 1; moistened with a solution of 1 oz. zinc chloride in 6 drachms of water. Where it is to be used as a capping or temporary filling over freshly exposed pulps the fluid should be zinc chloride, 1 oz.; water, 1 to 2 oz.; making a solution of only sufficient strength to cause the mixture to set. The cavity having been cleaned, creosote should be applied to the exposed pulp, and the oxychloride introduced in a semifluid state, and protected by a rubber dam from the fluids of the mouth until properly hardened (half an hour usually suffices). It is advisable to allow several days to intervene for the more thorough solidification of the cap prior to the removal of the excess of material and final insertion of the metal stopping.

(27) C. B. asks: How can I prepare gum dextrine? A. Crushed malt, 1 lb.; warm water, 2 gallons; mix, heat to 145° Fah; add 5 lb. starch, raise the heat to 160°, and mash for about 25 minutes or until the liquid becomes thin and clear. Then run off immediately, and boil for 3 or 4 minutes to prevent the formation of sugar; filter, and evaporate the liquid to dryness.

(28) E. R. H. asks: 1. What can I use with sand and silicate of soda to make the latter water proof when making artificial stone of great strength: is there any acid that will do it? A. Dilute sulphuric and muriatic acid, also carbonic acid, have been used.

(29) I. H. P. writes: I have now on hand a lot of sumac leaves gathered in July and August, to experiment on. I wish to make the extract fluid and solid from the sumac leaves. My chemist has made samples: he uses acid which eats up the leaves and leaves behind a heavy thick pasty substance. Would this do? I intended to manufacture it in my chemical works. If you can enlighten me on this I shall be under many obligations to you. Can you give me the name of a work treating on it? A. Dry, powder, leach with hot water, filter, and evaporate the liquid (preferably in a vacuum pan) to the proper consistency at a moderate temperature. From your statements we cannot judge of the extract prepared for you.

(30) P. W. asks how to get the rust off my hand, made by cast iron? Am at present using pumice stone and castile soap, but it takes too much. A. Try a little dilute muriatic acid; then plenty of water.

(31) J. S. asks how to mould sealing wax. A. The moulds usually employed are of heavy iron (so as to conduct away the heat rapidly). They are made in two pieces, each representing half the matrix. The strained wax is poured in from the top (end of stick). The mass of iron quickly chills the moulded stick, and when the mould is opened the stick does not adhere to the smooth metal. The sticks then go through an ironing process which imparts the smooth gloss. If the wax is not properly compounded and strained the casts are likely to be imperfect under the best management.

(32) E. A. H. asks: To what extent can blocks of wood of about 2 inches in thickness be rendered fireproof? What is the easiest wood to treat and what the best process? A. Blocks of wood may be rendered superficially non-inflammable by saturating the fiber as far as possible with a strong aqueous solution of sodium tungstate (commercial). The most satisfactory way is to place the wood in a strong iron vessel, exhaust the air as far as possible with a suitable pump, then let in the hot solution and subject it to pressure, which forces the liquid into the fiber. Light porous woods are more readily saturated than the heavier and denser kinds. Wood thus impregnated will not take fire in contact with temporary flame. All organic bodies when heated high enough suffer destructive distillation, and as the gases evolved are quite inflammable, such bodies cannot be made strictly fireproof.

(33) J. J. W. asks (1) how much water and weight of quicklime to make cream of lime. A. One of lime to thirty or forty of water. 2. Also how much of same it would require to throw down the lime in ordinary limestone water. I wish to use about 30,000 gallons per day thus purified. A. It depends altogether upon the amount of lime and carbonic acid in water. Must be determined by chemical analysis, as no two waters are alike in this respect.

(34) S. S. K. asks a recipe for an amber varnish, suitable for varnishing a new violin. A. Fuse 6 lb. very pale clear amber in the gum pot, and add to it 2 gallons of hot clarified oil. Boil until it strings very strong, remove from the fire and stir in 4 gallons oil of turpentine. Allow plenty of time before polishing. 2. Is there any work published on the new process of milling? A. We believe not; but you will find several articles on the subject in back numbers of the SUPPLEMENT.

(35) S. R. asks how the pulp is obtained from sawdust, straw, or rags, of which water pails are manufactured, and if there is any material or chemical put into the pulp to bind or hold it together. Also the pounds pressure per square inch required to bring this pulp to the consistency of pine wood. A. The materials are boiled for some time in aqueous solution of caustic soda, rinsed, and reduced to a pulp of suitable fiber in the ordinary beating engine. The pulp is mixed with a sufficient quantity of resin size, glue size, or both, and with suitable coloring materials, and pressed into the mould. The pulp is often heavily loaded with earths, kaolin, etc. Both the screw and hydraulic presses are employed.

(36) D. M. T. writes: I have some trouble with nickel plated cast iron rusting through being exposed to a moist atmosphere. The work is carefully washed both before and after being plated, and has a heavy coat of the protecting metal, but still it rusts. I am told that in the east an undercoat of bronze or some similar material is used before plating, which prevents the rusting. Can you give me the process? A. Give the metal a thin coat of copper by electricity before nickel plating.

(37) M. S. O. writes: Having read a description of a home-made horse power in SUPPLEMENT, No. 190, I would like to ask some questions in regard to the machine. 1. Do you think it would be a serviceable machine to run several hours per day? A. Yes, if well made. 2. What should be the length of sweep to which the horse is attached to make the smallest possible circle? A. Should not be less than about 12 feet. 3. How large should the main pulley be to drive a shaft 120 revolutions per minute, pulley on shaft being 10 inches in diameter? A. About 8½ feet.

(38) N. G. B. writes: I frequently have occasion to change the marks and brands on oak barrels that have been stained to give them the appearance of age. How can I retain the parts scratched to make the color uniform? I have tried a copperas solution, but it gives oak a bluish cast. A. Use a more dilute solution of the copperas, and add a little sal-ammoniac; or use dilute nitric acid.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

G. M. W.—*a*, Powdered feldspar not kaolin. *b* and *c*, Partly decomposed mica schist. *d*, Clay slate. There is no such substance as that you mention. Second does not indicate oil. Quartz does not necessarily indicate the presence of metals.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending

October 26, 1880,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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Water supply for cities and towns, system of, G. E. Beach 233,594
Water wheel, L. A. Pelton 233,692
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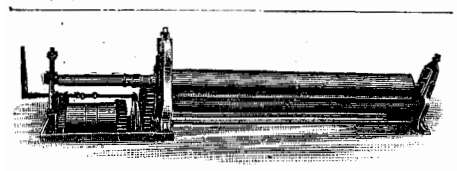

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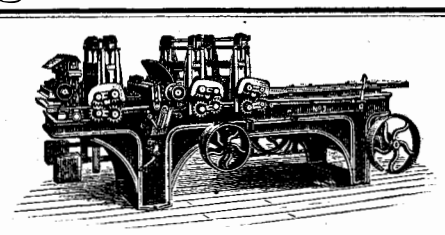

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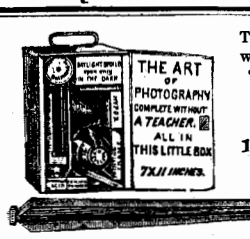

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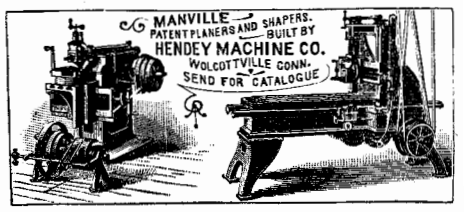

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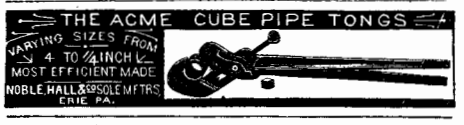

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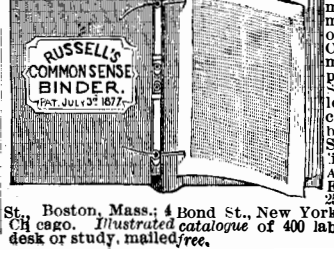

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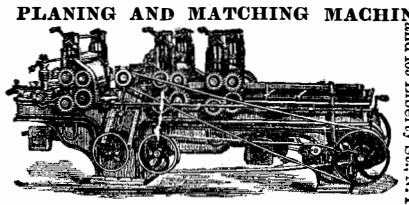

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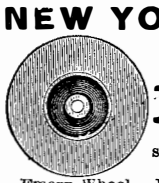

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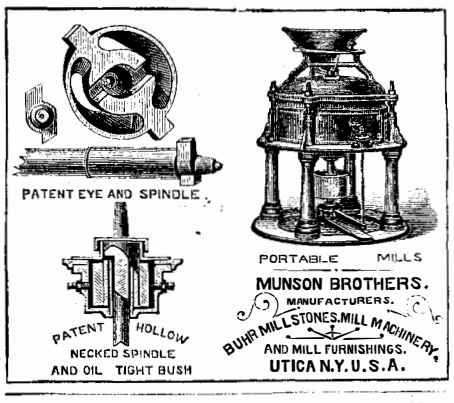

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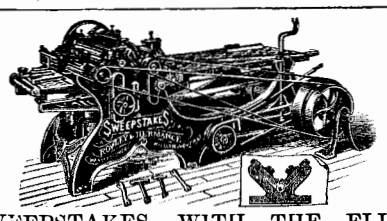

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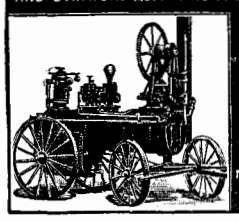

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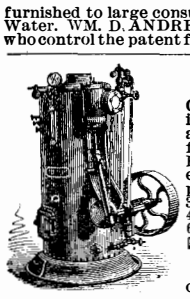

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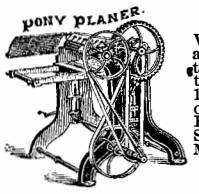

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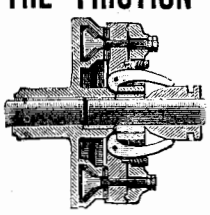

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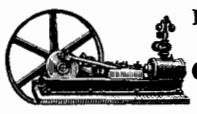

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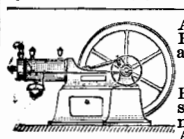

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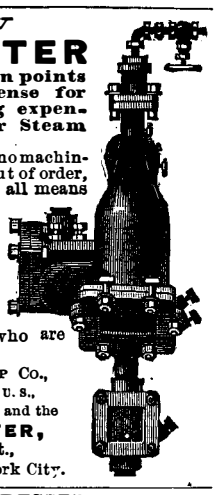

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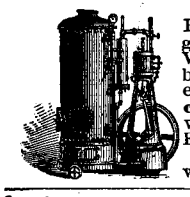

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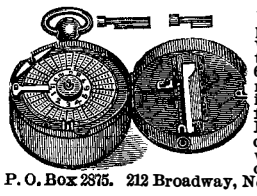

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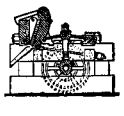

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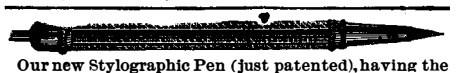

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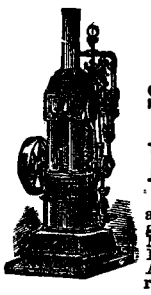

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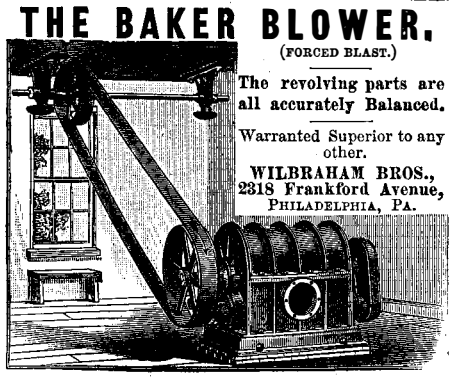

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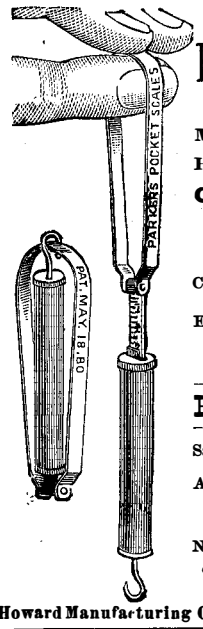

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